E06364

FOOD VALUES AT A GLANCE

and

HOW TO PLAN A HEALTHY DIET

By

VIOLET G. PLIMMER

(part author with Professor R. H. A. Plimmer
of *Food, Health, Vitamins*)

With 41 *tables and charts of which* 27
are in colour

LONGMANS, GREEN AND CO.
LONDON · NEW YORK · TORONTO

LONGMANS, GREEN AND CO. LTD
OF PATERNOSTER ROW
43 ALBERT DRIVE, LONDON, S.W.19
17 CHITTARANJAN AVENUE, CALCUTTA
NICOL ROAD, BOMBAY
36A MOUNT ROAD, MADRAS

LONGMANS, GREEN AND CO.
55 FIFTH AVENUE, NEW YORK

LONGMANS, GREEN AND CO.
215 VICTORIA STREET, TORONTO

FOOD VALUES IN WAR-TIME
BY
VIOLET G. PLIMMER

FOOD, HEALTH, VITAMINS
BY
PROFESSOR R. H. A. PLIMMER, D.SC.
AND VIOLET G. PLIMMER
Ninth Edition
With Coloured Frontispiece and 2 Diagrams in the Text

A SQUARE MEAL
Being the Frontispiece to the above
Mounted on card and sold separately

First published October 1935
Reprinted January 1938
Second edition 1939
Reprinted April 1941, June 1942
and May 1943

CODE NUMBER: 16417

Printed in Great Britain by
Lowe and Brydone Printers Limited, London, N.W.10

TO THE
PRIMARY AUTHOR
R.H.A.P.

PREFACE TO 1st EDITION

Valuable facts lie buried in columns of figures relating to chemical analyses of foodstuffs. Figures are such dead things until we can graphically visualize them. If the various constituents of a food were distinctively coloured like the layers of a Neapolitan ice and branded with their vitamin content, then the nature of each foodstuff could be seen at a glance. Since foods are not so self-explanatory, I thought that charts coloured on the Neapolitan ice principle to show the percentage composition and vitamin content of foodstuffs would be helpful to those who are concerned with nutritional problems. By means of these charts the composition of any foodstuff can be rapidly compared with that of any other food without recourse to figures.

In addition to the charts, the general principles of nutrition have been summarised to enable the reader to plan either individual meals or to cater on a large scale.

I have to thank the Controller of His Majesty's Stationery Office for kindly granting permission to use for this purpose the *Analyses and Energy Values of Foods* prepared by R. H. A. Plimmer for the Army Medical Authorities. Additional unpublished analyses by Professor Plimmer are included.

V.G.P.

PREFACE TO 2ND EDITION

Since the book first appeared more foodstuffs have been tested and their vitamin content measured in international units. Three black and white charts and several numerical tables have been prepared for this edition to show at a glance the vitamin content of most ordinary foods. The values given are the average data drawn from various sources, in particular from figures kindly supplied by Dr. Katherine H. Coward from the laboratory of the Pharmaceutical Society, London; from the *Vitamin Content of Foods* compiled by Daniel and Munsell for the U.S.A. Dept. Agric. Miscellaneous Publications No. 275: from the Tables of Fixsen and Roscoe in *Nutrition Abstracts and Reviews* published by the Rowett Institute, Aberdeen.

The text has been revised and brought up to date and new sections and an index added. I have to thank Sir Albert Howard, C.I.E., M.A., for kindly reading the proofs of the final section, *the place of food in the cycle of life.*

The essential facts about food requirements and food values are known but in practice seldom applied. Many of the bigwigs in the spheres of medicine, physiology and agriculture, who sit on authoritative committees and issue informative pamphlets for the guidance of the public are still imbued with the spirit of the pre-vitamin era, and delay rather than accelerate the application in daily life of the *newer knowledge of nutrition.*

I feared that this book might give the impression that food values are merely columns of figures or neatly printed charts. The tragi-absurdities of the nutritional problems which arise in everyday life have made it impossible to treat the subject of food values with the aloof detachment that laboratory science demands, because food has absolutely no value until eaten by someone who needs it. The subject of nutrition and malnutrition is interwoven with the whole texture of life and cannot be separated from it. The value of food can only be considered in relation to other vital activities like farming, housing, trade, finance and the disposal of organic waste material. The confusion and cross purposes, the wastefulness and profiteering, the stupidity and ignorance that go on in this business of feeding ourselves, and the risk of a food shortage in wartime, have tempted me to stray far afield. If I have been overcensorious and apportioned blame too readily it is because "*I would have none live in poverty, straits and sorrow.*"[1]

Finally I would like to clear up a misconception. The fact that I have written a book on food and have been joint author with my husband of other books on food has caused me occasionally to be mistaken for an *expert on nutrition*. I have no qualification or desire to rank as *an expert* and have no enthusiasm for a subject of such dull necessity as food values and dietetics. The reason for making this book was that no book on nutrition gave in a small space all that I needed to know in a form that was not too technical. Books written by real experts often give a distorted close-up view of some small section of a subject and pay too little heed to inter-relationships with the work of specialists in other branches. I have had to collect little bits and pieces of information and fit them together to try to make what I hope is a clear picture in proper perspective. V.G.P.

July 1939.

POSTSCRIPT, OCTOBER 1939

Food is the first line of defence against physical disease and in wartime against the enemy.

This new edition was written in the belief that we should soon be involved in a European war, and war has come while the book is still in the press.

In war events move rapidly, all is change and flux and old prejudices and wasteful habits disappear. While everything is again in the melting pot there is the opportunity to recast and modernise our defences on the food front on the lines here suggested for the provision of Square Meals for the nation.

And when the war is ended may the survivors aim at securing square deals and square meals for all the people in the world so that none may live in "poverty, straits and sorrow."

---

[1] The words of Gerrard Winstanley (b. 1609).

CONTENTS

PAGE

FRONTISPIECE. SQUARE MEAL CHART

INTRODUCTION 11

MALNUTRITION. THE DANGERS OF COMPLACENCY . . 13

THE PURPOSES OF FOOD 20

A COMPLETE DIET 22

THE VITAMINS AND THE EFFECTS OF VITAMIN UNDERFEEDING 32

THE QUANTITY OF FOOD REQUIRED 41

COMPOSITION OF THE DIET 47

THE DAILY QUANTITY OF PROTEIN 50

THE DAILY QUANTITY OF MINERALS 54

THE SUPPLY AND CONSERVATION OF VITAMINS . . . 56

A TYPICAL DAY'S FOOD FOR AN ADULT 69

LARGE SCALE CATERING FOR SCHOOLS OR INSTITUTIONS . 72

ECONOMIC DIETS 81

SQUARE MEALS 85

NOTES ON FOODSTUFFS 93

FOOD VALUES AND AGRICULTURAL POLICY . . . 106

MALNUTRITION AND THE COST OF LIVING. . . . 116

THE PLACE OF FOOD IN THE CYCLE OF LIFE . . . 121

TABLES 1 TO 14 132

COLOURED CHARTS 1 TO 26 155

INDEX 181

INTRODUCTION

There is probably no field of human thought in which sentiment and prejudice take the place of sound judgment and logical thinking so completely as in dietetics. (V. STEFANSSON.)

The diseases of civilization are produced by the practice of building society with rotten material. (G. BERNARD SHAW.)

BEFORE the nineteenth century food supplies were produced and marketed locally. Industrial development concentrated large populations in towns to which food is brought from long distances, even from the other side of the world. This unnatural state of affairs has many dangers. To protect the consumer there is legislation to ensure that the food sold shall be what it claims to be and in good condition and free from harmful added substances. Grading according to quality is being introduced and home and foreign produce distinctively marked. Further than this, it is not easy for legislation to go. The wise or unwise choice of food still rests with the individual and with the large-scale caterer. No instinct can help us to choose unerringly from the endless variety of foodstuffs sold in shops. Many of these products have been subjected to commercial processes which modify the nutritive value for better or for worse. To choose wisely some knowledge of food values is imperative.

The science of nutrition marches far in advance of its application either in daily life or in preventive or curative medicine. The knowledge is there waiting to be used. Health depends not on how much money is spent on food, but on what foods the money is expended. Malnutrition occurs at all levels of income.

The ordinary person can plan his or her daily food without elaborate calculations, although if the diet is very little varied from day to day the proportions of the constituents should be checked to see that they conform to satisfactory standards.

Institutional or school caterers who do not plan the diet on a physiological basis, calculating and checking the consumption of food, seeing that it is fairly distributed and not wasted, should not have a moment's peace of mind. They are responsible not only for the present, but for the future well-being of many. Small errors of diet are cumulative in effect and though for a time there is no obvious harm, irremediable trouble may follow later.

The path of the conscientious caterer is here made as easy as possible by the tabulation of food values for quick reference. Weekly budgets and menus have been prepared as *samples*, but no good housekeeper either institutional or domestic can work to ready-made menus : there are too many variable factors to be considered. Caterers must understand the requirements of their particular community ; pander within reason to likes and dislikes ; allow for the varying degree of skilfulness and willingness of the domestic staff ; be on the alert to profit by local or temporary gluts of certain foods and prepared to find suitable alternatives for articles which are scarce or too costly.

The question which foods offer the best value for the money spent cannot be adequately considered as prices vary greatly in different localities and seasonally, and change more rapidly than a book can be published. As rough guides Tables of the Energy Value and of the Protein Value of Shillingsworths of some common foodstuffs have been included. Since 1935 when these tables were made the cost of living has risen and is still rising and a shilling buys less. The relative price values of one kind of food to another are roughly the same, that is the expensive foods in 1935 remain the more expensive foods.

The significance of vitamins cannot be fully appreciated without a knowledge of the way in which each vitamin was discovered, of the deficiency diseases associated with their absence from the diet, and methods of testing foodstuffs for vitamins. Here there is no space for such detail, but an account will be found in *Food, Health, Vitamins* by Professor R. H. A. Plimmer and V. G. Plimmer, to which this present book is supplementary.

MALNUTRITION. THE DANGERS OF COMPLACENCY

Nutrition is the process of normal growth and healthy maintenance of the body in substance and in function promoted by food appropriate both in kind and quantity.

Malnutrition is disordered nutritional process manifested in imperfect growth and failure of health consequent upon the habitual consumption of food unsuitable in kind though it may be ample in quantity. Malnutrition is quite distinct from a state of undernourishment or semi-starvation which is the effect of too little food. The faults in diet which lead to malnutrition fall into two classes :

Excesses. The over-consumption of certain kinds of food.

Deficiencies. The failure to provide all or enough of materials indispensable for the structure and for the proper function of the body.

MALNUTRITION is very widespread perhaps because a common attitude to food is " *Why worry ! If I have to think about every mouthful I eat life won't be worth living !* " To feed oneself properly there is no need for a hypochondriacal twittering about food, digestion and indigestion before, during and after every meal. The habit of eating the right foods is easy to acquire and saves trouble in the long run. The specialized demands of the body for materials can be squared up and understood once and for all and right feeding become as automatic as neat dressing until it would seem as careless and stupid to eat an ill-balanced meal as it would to go out in odd shoes or with one on and one off. Those who cater for others should feel as ashamed at providing a badly planned dietary as they would if they allowed those for whom they are responsible to wear rags. There is far more interest taken in the materials of which clothes are made than there is in the materials on which the structure and health of the body depend.

Before the 1914–18 War most of the so-called *diseases of civilization* were attributed to positive agents such as infective organisms, chemical poisons or bacterial toxins. War brought us face to face with various food deficiency diseases which had been considered peculiar to far-away times or places. Unexpectedly it was discovered how near the average diet comes to the frontier of inadequacy. More and more of the chronic ailments and organic diseases from which civilized people suffer are being traced to long-continued dietary errors.

The fall in the general death rate from year to year suggested an improved health standard, but the general death rate is not a reliable clue to the physical condition of a nation. Analysis of the returns shows that the decreased mortality refers chiefly to ages under five years, accounted for partly by the smaller size of families and greater individual care in infancy, and due especially to a systematic attack on all communicable diseases. Among the adult population there has been increased mortality from cancer, diabetes, pernicious anæmia, diseases of the heart and other degenerative organic diseases. Chronic ill-health is so prevalent in middle-life that it has been passively accepted as an unavoidable penalty of advancing age.

But everybody has to die from some cause some time, so again there is the cry "*Why worry! I'd rather have a short life and a merry one than fuss about food.*" The argument against this happy-go-lucky creed is that though life may be *short* it cannot possibly be *merry* if teeth are decayed, gums have pyorrhoea, digestion is upset, bowel constipated, heart and other internal organs function imperfectly, feet are flat and the skin marred with sallowness and other blemishes. These are a few of the symptoms correlated with wrong dietary habits and which may be regarded as avoidable evils.

Ordinarily there is no mechanism for assessing the health standard of the nation. War conferred one benefit which peace has not provided. War demanded a national stocktaking of the physical condition of every man of fighting age, that is of working age, in the prime of life. The findings are set out in the official Report of the Ministry of National Service (1920). In the words of the Report the collected data

> "throw a lurid light upon the effects of civilization upon the adolescent population . . . This stocktaking brought us face to face with ugly facts, and, one hopes, awakened us from the complacency with which in the past we treated our most important asset *the health of the nation.*"

In the industrial areas men of 38 were described as "old men." In its final summary the Report concluded :

> "The medical examinations show that of every nine men of military age in Great Britain, on the average :
> Three were perfectly fit and healthy ;
> Two were upon a definitely infirm plane of health and strength ;
> Three were incapable of undergoing more than a very moderate degree of physical exertion and could in view of their age be described as physical wrecks ; and the
> One remaining man was a chronic invalid with a precarious hold upon life."

The best and worst grades of those *passed as fit* for active service have left as a legacy the familiar terms A1 and C3. We are accustomed to think of C3 as the lowest level and forget all those dregs of humanity *rejected* as physical wrecks and chronic invalids. The gradings were carried out hurriedly and leniently and under- rather than over-estimated the degree and extent of physical disability and disease.

In one Yorkshire town the battalions "lost more than half their effective strength by the onslaughts of civil life." In another town "seven out of every ten are *hors de combat* before they even shoulder a musket."

A large proportion of rejections came under the vague heading "Poor Physique." Defective teeth, knock knees and flat feet were common disabilities. According to the Report:

> "Experience teaches us that the most fertile cause of Poor Physique in children is the gross ignorance of the simplest forms of domestic economy amongst the mothers . . . The difficulty was not due to poverty except in a practically negligible number of cases but to *the lack of knowledge* of the mothers who could have afforded to buy the necessary food. . . . Many cases of Poor Physique are due to the effects of rickets. Very often this malady does not affect the bones and joints but does harm to the digestive and blood-forming systems, leading to anæmia, dyspepsia and stunted growth.[1] The disease is due to faulty feeding. . . . Rickets by causing pelvic deformity leads to great increase of the risks of maternity."
>
> "One depressing aspect of this state of affairs is *the dull contentment* with which so many (of the unfit) accept their condition. They know no better. Are they not just like so many of their fellows ? "
>
> "Army training demonstrated beyond all doubt the wonderful improvement in health that can be attained by suitable food, regular hours, fresh air, and physical training even in the most unpromising human material."

---

[1] Symptoms now recognized as distinct from rickets which is caused by lack of vitamin D. The anæmia and dyspepsia are due to the absence of other vitamins and of iron (pp. 37, 39).

The same low physical standard of Army recruits continued. The Adjutant-General reported in 1934 that:

> "No really physically unfit man presented himself for enlistment. What was disconcerting to any citizen with a care for the good of his country was that over fifty-two per cent. of the men who went to the recruiting office did not come up to the physical standard laid down. In the big industrial areas of the North the percentage of rejections rose to sixty-eight per cent. . . . In the twenty weeks of an infantry training depot the average recruit put on 8 to 8½ lb."

and he concluded by blaming the women for the way in which the men had been fed at home.

What is the physical condition of the people now, twenty years after the compulsory wartime stocktaking? There are no systematic records of the national health, only scattered data exist.

> "The present situation is that if three men come forward to enlist, one is rejected at sight, the second is rejected for physical, medical or educational reasons and the third is finally approved."[1]

Out of the last million men[2] to offer approximately 650,000 were rejected in spite of the lowering of physical standards as regards, height, defects of vision, and the condition of teeth.

In view of this continued heavy rejection rate for the Army there is no reason to assume, as has been done, that we are now an A1 nation because the rejection rate among the first batch of Militiamen was only 2.3 per cent. The standard of being merely "*fit for training*" is not comparable to "*adequate to withstand the work and life of a soldier.*" The army recruits are drawn mainly from the ill-fed poorer classes while the Militiamen are a slice of humanity cutting all levels of income.

A review of the conditions existing among the civilian population offers no cause for the belief that we have attained the status of being an A1 nation for physical fitness or that any material improvement can be derived from physical training and more playing fields in the absence of better food.

There is heavy maternal mortality in childbirth, a mortality which among other causes includes nutritional errors past and present. After an investigation of the relation between faulty diet and disease it was stated at a conference of the British Medical Association (1934) that in one of our cities 50 per cent. of the working-class women of childbearing age were suffering from nutritional anæmia.

---

[1] Army Council Report quoted in *The Times*, July 1939.

[2] Before outbreak of war 1939.

During the seventeenth week of pregnancy the permanent teeth begin to develop and poorly nourished mothers produce children with imperfectly formed teeth. In 1936 out of nearly 3½ million school children examined almost 2½ million needed dental treatment.

Blood tests have shown that the majority of the children in the poorer classes are deficient in iron. A recent medical survey by the Peckham Pioneer Health Centre for families of the artisan class revealed that 90 per cent. of those over 25 years of age had some physical defect and that the adolescents were to a surprising extent C3.

Other disquieting figures relate to the time lost to industry through the sickness of workers coming under the National Health Insurance Act.

> "Among the insured population there was lost in 1933 a total of 29,000,000 weeks work. To this staggering loss must be added the cost of replacement of labour and the expense entailed in the care of the sick during the period of incapacity. These figures represent a heavy burden upon the community which is largely unnecessary."

The number of weeks of work lost through sickness annually has since increased to over 30,000,000 weeks. These figures do not include illnesses lasting less than four days and take no account of the many workers who are ill but have not visited a doctor and carry on at a low level of efficiency. The nation's annual sickness bill including treatment and insurance has been estimated at roundabout £300,000,000 a year.[1]

The year 1939 completed the first quarter century of medical benefit under the National Health Insurance Act. The declared aim of the Act was "The prevention and cure of sickness." In their "*Medical Testament*"[2] the local Medical and Panel Committee of Cheshire review these twenty-five years and conclude that the Act has been successful in one of its purposes "*the postponement of the event of Death*" and that the "*fall in fatality is all the more notable in view of the rise in sickness.*" They declare that in preventive medicine the Act has done nothing:

---

[1] Report on the British Health Services published by "Political and Economic Planning" quoted by S. M. Herbert in *Britain's Health*. Pelican special. No. 527. 1939. Price 6d.

[2] *British Medical Journal*, April 15, 1939.

> "Our daily work brings us repeatedly to the same point '*this illness results from a lifetime of wrong nutrition!*' The wrong nutrition begins before life begins. . . . For one fatal case (of maternal mortality) there are hundreds . . . where the frail mothers and sickly infants survive."

This Committee of doctors has "*been amazed at the benefit conferred upon patients*" who adopted their revised dietary. They concluded that nutrition and the quality of the food are the paramount factors in physical fitness and that no health campaign can succeed unless the materials of which the body is built are sound. It is to be hoped that other committees of panel doctors and the physicians of great hospitals will follow this example of attacking disease by improving the diet.

All statistics which are available concerning various sections of the population show that the general level of health and physique are far below the *optimum*. Malnutrition is indicated as a responsible factor for this poor health.

The Why-Worry attitude and the comfortable belief that any diet containing a variety of foodstuffs is bound to work out all right in the long run, may together cause as many cases of malnutrition as does the lack of money to buy proper food.

The materials required by the body for its structure and upkeep are very simple: air to breathe, water to drink and proper food to eat. *That is all.* Drugs are not a necessity. Yet fortunes are made by the sale of patent medicines to those who have no money to waste and could more profitably spend it on proper food. Advertisements announce the variety of drugs obtainable in unlimited amounts without medical prescription. The headache, constipation, anæmia, dyspepsia, nervous debility, wasting, obesity, lung weakness and kidney trouble which patent medicines claim to relieve are all signs of malnutrition. Long continued errors of diet put the human mechanism out of order and drugs are taken in the vain hope that they may remedy past, present and future shortcomings or excesses of food.

To avoid such mistakes the facts we need to know are:

The various indispensable kinds of food material.

The relative proportions in which these different kinds of material should be eaten.

The total quantity of food required.

The consideration of the total quantity of food is best deferred until the various essential ingredients of the diet have been described. The amount and proportion of these essentials are dependent in their turn on the purposes which the food has to serve.

THE PURPOSES OF FOOD

Food as Building Material

For the infant in its mother's womb, the food derived from the maternal bloodstream has but one purpose, to provide materials for the proper construction of its body, and these the infant cannot obtain if the mother's diet is ill-chosen. Malnutrition may thus begin before birth and the child start life a weakling.

To construct a building the architect specifies suitable materials and the quantitative surveyor calculates with fine accuracy how much of each kind will be required. Nothing is left to chance. Similar methods of precision in ordering food materials have been found by breeders of animals to produce finer stock at less cost than by the old haphazard system. It is seldom that the materials for the construction and upkeep of the human body are assembled with calculated foresight. A random assortment, too much of some kinds and too little of others, is thrust into the mouth with touching faith that from the muddle will be produced a durable structure, pleasant to look at, working efficiently and able to resist the weather and the entry of intruding disease germs.

The body is adaptable and makes the best of a bad job by rejecting what is useless or excessive and keeping what is useful, but the organs of elimination may be overstrained and the body cannot make something from nothing. A slight shortage of even one essential weakens the whole fabric. It is to the inadequate provision of one or more indispensable materials that the prevalence of poor physique and disabling illness must be attributed.

Food as Fuel

As soon as the infant is born food is required for other purposes than growth. Deprived of maternal warmth and carriage, food is burned as fuel to keep the body warm and provide energy for movement.

The greater part of the food serves as fuel and forms no part of the living structure.

Foods that Regulate and Protect

In addition to structural material and fuel for energy, small quantities of mineral salts and vitamins are needed. These substances are sometimes grouped together as *protective foods* because their absence causes disease and their presence promotes health and increases resistance to infections. They have also been compared to lubricants as they ensure smooth working; such a comparison must not be taken too literally for lubricants are not part of the machine; some mineral salts certainly and vitamins most probably form part of the living structure.

A Complete Diet thus provides in suitable proportion materials for structure, for fuel (energy supply), for regulating the functions of the various parts and co-ordinating and protecting the whole.

A COMPLETE DIET

CHEMICAL analyses, as represented in the coloured charts at the end of this book, show that almost the entire weight of a foodstuff is made up of five groups of substances: *the proteins*, *the fats*, *the carbohydrates*, *the mineral salts and water*. In amounts too small to be expressed in percentages are other indispensable constituents. Amongst these *the vitamins* by their biological properties have an importance out of all proportion to their estimation by weight.

After all water has been removed from foodstuffs a solid residue is left consisting mainly of *organic* material and a lesser amount of *inorganic* material which remains as *ash* after the organic material has been burned. It is the combustion within the body of the organic substances, protein, fat and carbohydrate which gives warmth and energy. The residual ash consists of mineral salts. Protein serves not only as fuel but also as the primary structural material.

Water

Strictly speaking, water and oxygen are both foods.

The watery streams of lymph and blood irrigate every part of the body cleaning the tissues and distributing dissolved food material. Water is the vehicle of the digestive enzymes and of the internal secretions or *hormones*. Water swills away the débris of the tissues into the waste excretions, urine and sweat and out-breathed air. It is good to drink plenty of water, or watery fluids, 3½ to 4 pints daily, to wash impurities out of the tissues. In normal health fluid taken with meals does not upset the digestion.

Life can be maintained for several weeks without solid food by professional fasters; without water they would quickly die. Water is formed during the combustion of foodstuffs in the body, but not in sufficient quantity to compensate for the loss of water by perspiration, respiration and excretion.

In the charts of food analyses water is coloured blue and it is surprising how much water is contained in apparently solid foods.

Proteins

Proteins are nitrogeneous substances intimately associated with living cell protoplasm. The word protein is derived from the Greek word meaning "*I am first,*" that is, protein is *pre-eminent* as material for the growth and repair of animal tissues.

Plants can build up proteins from nitrates in the soil, and some have the power of fixing and using for this purpose the nitrogen in the air. Animals cannot make proteins for themselves and depend for their supply on plant food or on the tissues of other animals.

Ultimately all animals are dependent upon proteins constructed by plants, and it at first appears contradictory that in Table 4 plant proteins should be marked Second Class to denote their inferiority. As food for human beings, animal proteins have a higher *biological value,* that is, they are more efficient and economical than plant proteins for the growth and repair of tissues.

The *quality* of protein, whether it ranks as first or second class, depends upon its chemical structure, which is very complicated. Each protein molecule is an aggregate of a number of units called *amino acids,* highly complex nitrogenous compounds some of which contain other elements such as sulphur or phosphorus.

Proteins differ from one another according to the kind, number, proportion and order of arrangement of the amino acids with which they are constructed. Twenty-two different amino acids have so far been identified, and of these only the simplest can be synthesized in the animal body: the others must be supplied ready-made in the food.

Some amino acids are rare and others relatively common. All animal proteins, with the exception of *gelatin,* contain some of every kind of amino acid. Instead of trying to remember their unfamiliar chemical names we can think of the amino acids as lettered like printer's type. Proteins containing one or more of every *letter* are *complete* or *first-class* proteins. Plant proteins are *incomplete* or *second class* because they contain a superfluity of the commoner *letters* and some of the rarer *letters* are missing.

In a mixture of two kinds of incomplete protein the shortcomings of the one may be made good by the other, and every *letter* provided by the combination. Such proteins are said to be *supplementary*. It is assumed that seed and leaf proteins are supplementary because from this combination herbivorous animals build up complete proteins. Ruminants with their capacious stomachs derive all the amino acids they require from plant tissues and the surplus of the commoner kinds of amino acids are burned as fuel. Human beings thrive on a mixture of plant and animal proteins. The human digestive tract is not adapted to deal comfortably with a huge bulk of fibrous plant food, and may suffer from the omission of certain of the rarer amino acids if the proteins of a purely vegetarian diet do not happen to be supplementary. Most so-called vegetarians take some animal foods like egg, cheese, milk and dried milk powder in order to get complete proteins.

Assigning the milk protein *caseinogen* the arbitrary value of 100 it can be taken as a standard of reference for the biological value of other proteins as a supplement to wheat protein, as shown in Table 2 (p. 133).

These values were derived from growth experiments[1] with birds and the superiority of egg proteins may be a testimony to the efficiency of cannibalism as a system of protein nutrition. Babies start life as cannibals, and if mammals had been the test animals, the milk protein *caseinogen* would have taken first place and eggs second. The high value of meat and milk as compared with grass protein testifies to the selective process accomplished by herbivorous animals.

The amino acid *letters* are arranged in a definite *password* for each kind of protein. Not only is there a great difference between plant and animal proteins, but there are differences between the individuals of the same species and between the tissues of each individual. Blood from one human being cannot safely be transfused into another without preliminary tests to see if it answers the same *password* or it may cause a violent, perhaps fatal, reaction. Proteins from one animal injected into the blood stream of another species are poisonous. Therefore during digestion the protein molecules in the food are split up into separate amino acid *letters* which are circulated in the blood stream. Each cell picks out the *letters* that make the *passwords* of its special protein patterns. The odd *letters* left over are burned as fuel.

---

[1] Plimmer, Rosedale, etc. *Biochem. Journal*, 1934.

A few people react to certain foods. In one person eggs may cause sudden collapse ; in another shellfish produce nettlerash ; attacks of asthma or gout may occur after eating particular foods. Such cases are relatively rare and are explained by the theory that the offending protein escapes digestion into separate *letters*, is absorbed whole and because it answers no *password* is regarded by the tissues as an invading poison.

No natural food consists of protein only. The old name for proteins is *albuminoids*. Egg-white, that is, egg-*albumin*, consists mainly of protein and water. An almost pure protein sold under the name of *casein* is prepared from milk.

The soluble proteins *caseinogen* in milk and *fibrinogen* in blood coagulate or clot when acted upon by specific enzymes. The clotting of milk in the stomach is preliminary to digestion. In making junket and cheese the clotting is started by the enzyme *rennin* prepared from a calf's stomach and sold as rennet.

In the coloured charts protein is coloured red, and it is seen that dried beans, peas, nuts and cereals contain nearly as much protein as cheese or meat, but of inferior quality. In cooking pulses the dry seeds take up water and swell ; the percentage of protein will then be relatively less and correspond more closely to that of fresh broad beans and peas.

Fats

Fats serve as fuel to provide energy. All fats are equally good fuel whether in a solid form like lard or fluid like olive oil, the only difference being that oily fats are more easily and completely absorbed than those which do not melt at body temperature. Excess of fat in the food, if it is absorbed, is stored in the tissues as reserve fuel for emergency use. The accumulation of too much fat interferes with the chemical and mechanical efficiency of the tissues.

The chemical structure of fats is much simpler than that of proteins, and they contain only the three elements, carbon, hydrogen and oxygen. Fats are the most concentrated form of fuel food and on burning, weight for weight, give twice as much heat as either protein or carbohydrate. The saying "*Now the fat is in the fire!*" is a tribute to the heat which fat gives out on burning.

There is no chemical differentiation of fats into first and second class as in the case of proteins, yet we have to discriminate between fats *good* or *poor* for nutrition accordingly as they carry or do not carry the fat-soluble vitamins A and D.

In the analytical charts fat is coloured yellow, and Chart 12 represents some foods which consist of pure fat, or of fat and a little water. The vitamin index attached shows the presence or absence of vitamins; the vitamin-values vary greatly in different samples. In general, the vitamin value of animal fats is much higher than that of vegetable oils. (See Tables 9 and 12, pp. 144 and 151.)

Carbohydrates

Carbohydrate is the inclusive term for starch and the various *sugars*, *gums*, *pectins* and *cellulose* contained in many common foodstuffs. Carbohydrates are built up from the same three elements as fats: carbon, hydrogen and oxygen in different proportions and with an entirely different chemical structure. The hydrogen in carbohydrate is already combined with oxygen in the form of water and cannot be burned as it is in fats. The fuel value of carbohydrate is only half that of fat.

Carbohydrates, like fats, serve only as fuel and not as tissue-building materials. If eaten in excess of the body's energy requirements, carbohydrates are converted into fat which is stored in the tissues.

In the charts of food analyses, carbohydrates are coloured brown. There is no natural food consisting of pure carbohydrate, but refined sugar is a pure carbohydrate. Sago, tapioca, cornflour, arrowroot and potato flour consist of refined starch deprived of protein, vitamins and mineral salts, and are foodstuffs as incomplete and unnatural as pure sugar.

During digestion starch is converted into sugar and as sugar is absorbed into the blood stream. Except in a few special cases (p. 99), it is better to eat carbohydrate in the form of starch as present in unrefined seed and plant products admixed with other valuable substances. The conversion of starch into sugar occurs gradually during digestion, and the digestive tract is not suddenly flooded with sugar which in concentrated solution is liable to irritate the lining membrane and to ferment before it is completely absorbed.

The absorbed sugar is circulated in the blood and a small amount is converted in the liver and muscles into an insoluble carbohydrate *glycogen*, a reserve material sometimes called *animal starch*. Glycogen is reconverted into sugar as required and the amount of sugar in the blood is thus kept at a constant level.

The cell walls of plants consist primarily of a carbohydrate *cellulose* which in the charts is classed as unabsorbed fibre. Though herbivorous animals by digestive enzymes and bacterial fermentation are able to resolve it into sugar, cellulose is not digested in the human alimentary tract. Cellulose serves a useful purpose as *roughage*. The fibrous material mechanically stimulates peristalsis and acts as a tonic to a sluggish bowel. The fibres absorb and carry away poisons formed in the bowel from the putrefaction of protein.

Pectins are carbohydrates contained in the juice of fruit, turnips, etc. The gelatinization of boiled fruit extracts is due to pectin. Pectin is now sold under various trade names to make jam set quickly with a minimum of boiling.

Carbohydrates, like fats, are *good* or *poor* for nutrition, accordingly as they do or do not contain certain vitamins. In a natural diet the chief carbohydrates are *starch*, as it occurs in seeds, roots and tubers, and *sugar* diluted in fruit juice, and both associated with other essential food materials. In its civilized version, carbohydrate is eaten as refined starch or sugar. Sugar, a food lacking salts, proteins and vitamins, is by reason of its sweetness, cheapness and high energy value, displacing seed products as the staple carbohydrate food.

Mineral Matter

Mineral substances make no contribution to the energy value of foods as they are the residual ash after the organic material is completely burned. Dissolved in the body fluids, mineral salts help to regulate the heart-beat and the activities of all the tissues, and in some cases, as in the bones and teeth, enter into the actual structure.

Common salt, **sodium chloride,** is the most familiar salt. Without sodium chloride the stomach could not secrete hydrochloric acid, a normal constituent of gastric juice, which assists in the digestion of proteins, in killing disease germs and in preventing fermentation of the stomach contents. Salt is dissolved in the blood plasma and lymph which bathe every cell of the body. Sodium chloride is present in most animal foodstuffs, and its use as a condiment is ordinarily a matter of taste rather than a physiological necessity, except for vegetarians whose plant food is rich in potassium and poor in sodium salts, and for those people who through occupation or climate are drained of salt by copious perspiration.

Lime or **calcium** salts and phosphates are required for hardening the bones and teeth. Calcium salts take part in the clotting of blood and in the curdling of milk. Milk, cheese, eggs and almonds provide both calcium and phosphorus (Table 8). Some of the soluble calcium salts combine with digested fat to form insoluble calcium soaps which are not absorbed. The calcium of milk and cheese is better assimilated if taken in conjunction with acid, as in fruit and milk, or cheese with salad dressed with lemon juice or vinegar.

Phosphorus compounds are present in cell nuclei, especially in all actively growing tissues. The importance of a proper supply of phosphorus to growing animals is thus obvious. Cheese, eggs, nuts, the products of whole seeds, fish and meat are rich in phosphorus (Table 8, p. 143).

The secretion of the thyroid gland contains **iodine.** Insufficiency of iodine is a contributory cause to certain forms of goitre, that is enlarged thyroid. Enlargement of the thyroid is more common among women than among men. A diet which contains just enough iodine becomes inadequate during pregnancy and lactation when iodine is passed on to the growing child. Iodized table salts and medicines are sold. It is possible to take too much iodine in this way. It is safer to take iodine in the form of sea-products, fish and shell-fish. In some coastal districts seaweed is eaten in a jelly like brawn. Seaweed used as manure gives iodine to vegetable crops.

Sulphur is a constituent of animal proteins and foods which supply protein as a rule supply sulphur also. The proteins of leguminous seeds (pulses) are poor in sulphur and need to be supplemented by other proteins.

Potassium salts are widely distributed, especially in plant foods. Vegetarians get an excess of potassium and too little sodium, an inequality which is adjusted with the help of table salt. For the same reason, herbivorous animals have a hunger for salt.

Magnesium is also needed and occurs in much the same foods as calcium and in chlorophyll, the green pigment in plants. There is unlikely to be a shortage of potassium or magnesium salts in a well-mixed diet.

Manganese appears to play some part in the processes of reproduction, lactation and growth. An adequate supply of manganese is ensured by the consumption of whole seed products. Manganese is removed in the preparation of white cereals.

Iron is a constituent of the blood pigment, *haemoglobin*. Milk is poor in iron. Young animals and children require more iron than adults, and if kept too long on a purely milk diet may become anæmic. Dried pulses, wholemeal cereals, green vegetables, eggs, liver and meat are some of the foods rich in iron. (Table 8). Not all the iron in foods is absorbed, but women and children can be protected against anæmia by foods rich in iron.

Traces of **copper** assist in haemoglobin formation. Except in minute traces copper is poisonous.

The young animal at birth has a store of copper and iron salts in the liver, but is short of calcium. To ensure that neither the mother nor the young shall suffer damage during delivery, the bones at birth are not hard but of soft flexible cartilage. After birth the infant has urgent needs for calcium and phosphorus for the hardening of the bones and the development of the teeth.

According to Sherman[1] the negative calcium balance at birth is not easily made good, and in American dietaries calcium is more likely to be deficient than any other mineral element. He recommends that a quart of milk should be taken daily throughout the period of growth to maintain the calcium supply in an assimilable form.

A mixed diet consisting of milk, cheese, eggs, greens, sea-fish and whole seed products will supply all the essential minerals in sufficient quantity.

The Vitamins

At the beginning of this century vitamins were unknown, and physiologists believed that protein, fat, carbohydrate, mineral matter and water, in suitable proportions and amounts provided a complete diet. Then it was discovered that if these ingredients were prepared in a chemically pure state, combined in suitable proportions and fed to rats, the animals failed to grow and soon declined and died. To explain this failure the existence of certain unknown **accessory food factors** was postulated. These indispensable unknowns later were called **vitamins** because each one of them is **vitally** necessary. They were distinguished as A, B, C and so on, until their chemical nature was discovered. This system of lettering is still used, although most of the vitamins have been prepared in a pure state, their chemical constitution ascertained and distinctive names bestowed.

In spite of all that is known about vitamins and their chemical constitution, they are still regarded by many people as mysterious substances and laughed at as the fetiches of food faddists. Vitamins are wonderful rather than mysterious, because of their almost miraculous potency in minute amounts. Chemical tests for estimating the amount of vitamins in foodstuffs are replacing the laborious feeding experiments. The vitamin content of foodstuffs is now evaluated in terms of International Units fixed by the League of Nations' Technical Committee.

In chemical constitution each vitamin is unrelated to any other vitamin. One vitamin cannot replace another as one fat, one carbohydrate, or even one protein, can replace another. Each vitamin has its own distinctive functions. The human body cannot make vitamins for itself and either the vitamins or their **precursors** must be supplied ready-made in the food.

---

[1] *Food and Health*, H. C. Sherman, 1934. Professor of Chemistry, Columbia University (MacMillan and Co.).

Deprivation of any one vitamin will cause death in a few months. A disease induced by a diet in which a vitamin or any other nutritive essential is lacking is called a **deficiency disease.** In this country cases of specific vitamin deficiency are rare. It is seldom that the diet is devoid of any one vitamin. It is almost equally rare that the diet contains an *optimum* amount of all the vitamins. Sooner or later, according to the number of vitamins which are insufficiently provided and the degree to which each falls below the optimum, there is a gradual failure of health. If the diet is not properly remodelled before it is too late, chronic intractable disease develops.

However cheaply synthetic vitamins may eventually be prepared, natural foodstuffs are preferable to synthetic because there is always the possibility that the natural product may contain other unrecognized essentials. Moreover, with natural foodstuffs there is no danger of overdosage as there is with concentrates or with the pure vitamin in the case of vitamin D.

If the diet consists *entirely* of milk, eggs, cheese or meat or fish, and butter, wholemeal and other wholeseed products, together with fresh fruits and green vegetables, a full supply of all the vitamins, mineral matter and other essentials will be provided. On the other hand, if the diet consists largely of white bread and other white cereals, sugar, vegetable margarine, meat, bacon and lard, it will be deficient both in mineral matter and in vitamins. The average diet falls between these two extremes and contains some but not enough of all the vitamins. A vitamin-poor diet is likely to be inadequate in mineral content. A well-balanced and complete diet consists of foods from each of the coloured sections of A Square Meal diagram (frontispiece).

THE VITAMINS AND THE EFFECTS OF VITAMIN UNDERFEEDING

SINCE each vitamin is an entirely distinct and unrelated chemical substance, the ill-effects of vitamin deficiency are very different in each case. Each vitamin and its supply has to be considered separately.

Vitamin A

Vitamin A, a fat-soluble vitamin, is formed from a precursory substance **carotene**, to which chemically it is closely allied. Carotene is one of the yellowish pigments in carrots, egg yolk and butter. Carotene but not vitamin A is formed in green leaves in sunshine. The yellow colour of carotene is masked in green leaves by the stronger colour of the green pigment *chlorophyll*. The yellow colour of oils from plant seeds is not due to carotene but to other pigments which have no vitamin value.

Carotene is converted into the active vitamin A in the liver and bone marrow of animals and it does not matter in which form it occurs in the food of animals whether as the active vitamin or as carotene, its inactive precursor.

The vitamin A potency of foods is shown in the yellow section of the Square Meal and in Table 9 (p. 144).

Vitamin A has been prepared as a pure substance and given the name *axerophthol* as it prevents an eye disease called xerophthalmia.

Vitamin B Complex

Vitamin B complex is an inclusive name for a group of water-soluble vitamins, at first believed to be one vitamin, occurring in yeast and in the bran and germ of cereals. It was differentiated into two distinct vitamins one which cured and prevented the disease beriberi and one which was believed to cure and prevent the disease pellagra. They were distinguished as vitamin B_1 and B_2. Later vitamin B_1 was found to be a group of several substances which were called B_1, B_3, B_4, and B_5, but of these only B_1 is important in human nutrition. Vitamin B_2 was found to consist of other substances as well as the anti-pellagra vitamin.

Vitamin B_1

Originally known as the anti-neuritic or antiberiberi substance, vitamin B_1 since its preparation in a pure crystalline form has been called *aneurin* in this country and *thiamin* in America. Its distribution in foods is shown in the brown section of the Square Meal chart.

Vitamin B_2 Complex

Vitamin B_2 (or G in America) has proved to be a complex from which three members have been prepared in a pure crystalline state and called *nicotinic acid* (vitamin B_7), *lacto-* or *ribo-flavin* (vitamin B_2 or G), and *adermin* or B_6. Of these the most important is nicotinic acid as it prevents pellagra.

Lacto-flavin is the fluorescent yellowish green pigment in the whey of milk and in other foods. Lacto-flavin and adermin must both be provided in the food of animals and are probably necessary for man also for growth and for the health of the skin. The effects, if any, of their absence in the human diet are not known. They are supplied by an ordinary mixed diet.

The distribution of these three members of the vitamin B_2 complex is shown in the red section of the Square Meal Chart.

Vitamin C.

This vitamin, which for many years appeared to be the most fugitive and easily destroyed, has been prepared in a pure state and given the name *ascorbic acid* as a tribute to its specific action in curing and preventing the disease scurvy or *scorbutus*. Rats, dogs, cows and birds do not require vitamin C in their food as they are able to make it from some other substance. Man, monkey, pigs and guinea-pigs must have the vitamin supplied ready-made. The distribution of vitamin C in common foodstuffs is shown in the green section of the frontispiece.

Vitamin D.

Cod liver oil and some other fish oils were known to contain a rickets-preventing, or anti-rachitic vitamin, which was called D.

Next it was discovered that irradiation by sunlight or by ultra-violet rays from a mercury vapour lamp, converted an inactive substance *ergosterol* into an active rickets-preventing vitamin. This was the first vitamin to be identified chemically and it was given the name *calciferol* because of its controlling influence on the calcification of bones and teeth. Calciferol was called vitamin D_2 and it was not the same as the substance in cod liver oil now distinguished as vitamin D_1. Other rickets-preventing vitamins have been prepared, D_3, D_4, D_5. D_3 appears to be the same as D_1 in cod liver oil. Vitamin D of one kind or another has a roughly similar distribution to vitamin A in animal fats and is included in the yellow corner of the Square Meal diagram.

Vitamin E

Vitamin E is another fat-soluble vitamin of wider distribution than vitamins A and D. Vitamin E is present in vegetable oils from which A and D are absent, and it is destroyed by rancidity. Vitamin E has been synthesized and is called *tocopherol.* There is no special section for vitamin E in the Square Meal Chart as it is contained in foods belonging to all four sections. The germ of cereals and green vegetables are the best foods to supply vitamin

Effects of Vitamin Deficiencies

The biological significance of the various vitamins is most easily appreciated by recording the signs of disease which arise from their absence or from an inadequate supply of one or more vitamins in the diet.

Vitamins A and D are somewhat similar in distribution and it was a long time before the effects of these two vitamins could be disentangled. It was known that rickety children were generally " chesty " and liable to suffer from convulsions and that cod liver oil could heal **rickets** and relieve these other troubles.

Now that the two vitamins have been isolated it has been proved that the defective calcification of bones and teeth is due to insufficient vitamin D in the food and that susceptibility to catarrhal infections is caused by a shortage of vitamin A. Convulsions (tetany) occur in rickety children when the blood is too low in calcium. Rickets may occur in breast-fed infants and can be remedied by giving fish-liver oil to the mother.

Both vitamins A and D depend for their formation upon sunshine and are more abundant in milk, butter, eggs and animal fats in summer than in winter. This accounts for the development of rickets in winter and its healing in summer without change of diet.

If the diet is for some months deficient in vitamin A or its precursor carotene, the resistance of the mucous membranes to infections is weakened and favours the development of catarrhal and inflammatory conditions of the eye (**xerophthalmia**), respiratory, digestive and genito-urinary tracts. The value of butter, cream, eggs and cod liver oil in the treatment of tuberculosis was recognized long before the discovery of vitamins. Conjunctivitis, broncho-pneumonia, infections of the middle ear and of the nasal sinuses, abscesses, puerperal septicæmia, " stone " in the bladder are unhealthy conditions associated with diets poor in vitamin A. Nightblindness, or inability to see in dim light, is a sign of lack of vitamin A. Administration of vitamin A foods, especially liver or liver oil, quickly restores the power of the retina to regenerate visual purple and the defect of vision is cured.

Sir E. Mellanby correlates certain forms of degenerative changes of the brain and nerves with shortage of vitamin A.

On a diet devoid of vitamin B_1 the disease **beri-beri** develops after a few months. The mortality from beri-beri is very high in races living mainly on white rice. The first symptom is loss of appetite. The digestive tract and heart are affected and finally there is paralysis of the limbs and death. Beri-beri in breast-fed infants is cured by giving the mother foods rich in vitamin B_1. In Europe and America acute cases of beri-beri are rare but the popular diet with white cereals, sugar, meat and fat as the staple foods, is very poor in vitamin B_1, far below the optimum.

Deficiency of vitamin B_1 is indicated by the prevalence of constipation, gastro-intestinal disease, enlarged heart and disordered rhythm of the heart. Diabetes is a by-product of civilization and is associated with diets containing a preponderance of white cereals and sugar and little vitamin B_1.

Lack of nicotinic acid (vitamin B_7) is the cause of the disease **pellagra** which has been responsible for thousands of deaths in countries where maize is the staple cereal. Nicotinic acid is present in yeast, meat, fish, milk, eggs and liver ; the preventive and curative power of these foods for pellagra was at first attributed to the good quality of the protein.

The symptoms of pellagra are melancholia ending in insanity, diarrhoea and digestive disorders arising from a failure of the hydrochloric acid secretion in the gastric juice, and finally the appearance of bisymmetrical areas of rough inflamed skin on parts of the body exposed to sunlight.

Foods rich in the vitamin B complex, such as liver and yeast extract (marmite) are one factor in the treatment of pernicious anæmia, suggesting the possibility that this disease may be caused by years of vitamin deficiency.

Scurvy, the disease due to lack of fresh fruits and vegetables, develops in about three months if the diet contains no vitamin C. In its acute form scurvy is now rare in Europe, though some cases come to hospital for treatment and there are still a few deaths from scurvy every year in this country. For each case of definite scurvy there must be many people who do not get enough of this vitamin, especially in winter, and suffer from poor health without knowing the reason. The earliest signs of vitamin C deficiency are nothing more definite than headache, fatigue, sallow complexion, low resistance to infection and a general feeling of malaise. In more severe cases there are pains in the limbs, nose-bleeding, spongy gums and loose teeth ; the bones fracture easily.

Scurvy commonly developed in bottle-fed infants until mothers and nurses were taught to give daily some fresh orange, tomato or swede juice.

Lack of vitamin E in the food is a cause of sterility in females. Women who have had a number of miscarriages have produced normal living children after treatment with wheat germ oil, which is rich in vitamin E. Abortion in animals has also been successfully treated with vitamin E concentrates. A natural method of obtaining this vitamin is from the germ of cereals. Vitamin E is present in wholemeal and not in white bread.

General Vitamin Underfeeding

The absence of any one vitamin induces signs of disease distinct from those caused by the absence of any other vitamin. Under ordinary conditions the specific deficiency diseases, scurvy, beri-beri, pellagra are rare because a certain amount of each vitamin is supplied in the food but not enough for perfect health and a confusion of symptoms arises from the interplay of more than one vitamin insufficiency. For example the symptoms relating to the digestive and blood-forming systems attributed to rickets in the Report quoted on page 15 indicate a shortage of vitamin B complex, C and of mineral salts and are not caused by the vitamin D deficiency which was responsible for the development of rickets. It is not unusual that the diet contains too little of all the vitamins and also of minerals.

The lowering of resistance to infection is not specific to vitamin A deficiency. A connection has been established between immunity and susceptibility to infections such as influenza, colds, boils and other septic conditions, in proportion as the diet is rich or poor in vitamin C and in the vitamin B complex. A high resistance to infection is only consistent with an entirely satisfactory state of nutrition.

Pyorrhoea which exacts the sacrifice of so many teeth appears to be the result of a vitamin-poor diet. We know that scurvy affects the gums and loosens the teeth and it is not surprising to learn that in many cases of pyorrhoea a history of vitamin C shortage has been discovered. Pyorrhoea has been successfully treated and dental decay arrested by giving the sufferers an abundance of vitamin C: 1 *pint of orange juice, the juice of* 1 *lemon and half a lettuce or its equivalent in raw cabbage daily*. But these foodstuffs also supply other vitamins, especially vitamin A. Dogs do not require vitamin C in their food and develop pyorrhoea[1] if they are short of vitamin A. It may thus be a combined lack of vitamins A and C which is responsible for the prevalence of pyorrhoea in human beings.

---

[1] *Nutrition and Disease* by Sir E.

Vitamins B_1 and nicotinic acid (B_7) and A all assist in the normal functioning of the digestive tract and in maintaining its resistance to infections. The prevalence of gastro-intestinal disorders and diseases, appendicitis, gastric and duodenal ulcers, colitis and cancer, in all civilized communities may be attributed to the consumption over many years of vitamin-poor foodstuffs. These diseases do not exist among primitive people living under very unhygienic conditions but eating foods which have not been deprived of their natural content of vitamins and mineral salts.

A slight shortage of vitamins has no immediate ill effect to give warning and make the connection of cause and effect obvious. In the course of years continuous slight deficiencies of the diet weaken every tissue both in regard to efficient functioning and in resistance to infection. The endocrine glands suffer from prolonged slight inadequacies of the supply of vitamins. Enlargement of the thyroid may be occasioned by vitamin deficiency as well as by lack of iodine. In normal health the suprarenals contain a large amount of vitamin C. Deprivation of vitamin B_1 causes enlargement of the suprarenals and a too profuse secretion of adrenalin. Vitamin A deficiency also affects the suprarenals.

To ensure that the diet contains *enough* of *all* the vitamins it should consist almost entirely of vitamin-containing foods from each section of the Square Meal Chart. Foods of high energy value but supplying little or none of the vitamins such as sugar, white cereals, lard, and bacon fat should be taken sparingly.

Few people eat exactly the same food. In a family or institution the food provided may be excellent but it becomes inadequate for the faddy individual who persistently rejects certain kinds of fat, or wholemeal bread, or greenstuff; or is too lazy to peel an orange, and thus restricts the intake of vitamins and mineral salts to below the *optimum* amount.

Detection of Vitamin Underfeeding

A practical difficulty in assessing the state of nutrition of school children is the absence of satisfactory standards.

Physical measurements of weight, height and chest in relation to age are useless as the sole guide. The decision as to whether a child is well nourished or not depends mainly on the general appearance, complexion, subcutaneous fat, posture, alertness, and the state of the mucous membranes. Judgments based on such data are influenced by the personality of the examiner, and the standards become debased to suit the human material which they have to measure. A child passed as *normal* in a depressed area would be labelled as suffering from malnutrition if contrasted with children of the artisan class in some more prosperous district.

As a primary standard the word *normal* should be restricted in its meaning and applied only to those who are *free from defect in structure and function.* If not so defined the term *normal* becomes merely a sliding term to mean no worse than the average of that particular sample.

Indirect evidence of the state of nutrition of day school children may be gained by the teachers from the mass observation of the children and from records of the incidence of coughs and colds, influenza and other infectious diseases ; the rate of healing of cuts and abrasions and the frequency of pus forming infections ; the prevalence of constipation, diarrhoea, indigestion ; the docility or boisterousness of behaviour in class and in playground.

Foods of high energy value such as flour, sugar and margarine are cheap and it is seldom that the food of even the poorest classes is too low in this respect. The usual cause of malnutrition is vitamin underfeeding and lack of iron, calcium, phosphorus, and a good mineral mixture generally. Standards for assessing malnutrition must disclose these faults.

Examination of the teeth indicates the state of nutrition of the child or of the mother before the child's birth. Shortage of vitamin D alone is not responsible for defective dental structure, caries and oral sepsis. These conditions are also caused by insufficiency of vitamin C and this fact is often overlooked.

Estimations of the haemoglobin content of the blood reveal that many children graded as normal are suffering from anæmia.

A variety of clinical tests are now available for detecting vitamin underfeeding :

Vitamin A.	Photometer test for nightblindness.
,, D.	Calcium and/or phosphatase estimation in the blood. X-rays examination.
,, B_1.	Urine examination of aneurin excreted.
,, C.	Estimation of ascorbic acid in the blood. Estimation of ascorbic acid output in urine. Blue reaction skin test with indophenol. Capillary resistance test.

These tests carried out on unselected batches of school children are useful as a means of convincing those in authority that vitamin underfeeding is the rule rather than the exception. To employ such tests as a routine for every school child would not remove the cause and would probably cost much more than the issue of free supplements calculated to make good the deficiencies in the average working class diet.

It is a foregone conclusion that malnutrition must be the prevailing state since it is reckoned that 25 per cent. of all the children in this country belong to families with an average expenditure of only 4s. a week on food. At present prices twice this sum is needed to buy proper food. In families which have enough money the knowledge or desire to buy the right kinds of food is too often absent.

Standards for assessing states of nutrition are thus of little practical value because the majority of children are not properly fed. The remedies are to bridge the gap that exists between the price of food and the money that the people can afford to spend on it, and to educate those who have the money to spend it more profitably. When the public and the medical profession realize the importance of nutrition and the damage caused by malnutrition, then, Lord Astor[1] promises a real National Nutrition Policy will be the next social reform. This reform is dependent on reorganisation of our present agricultural policy.

---

[1] Speaking at the British Medical Association National Conference on Nutrition and the Public Health. April, 1939.

THE QUANTITY OF FOOD REQUIRED

THE greater part of the food eaten is burned as fuel to keep the body warm and to provide energy for movement. The total quantity of food required each day is proportional to the energy expenditure. Even in sleep energy is used for the work of the lungs and heart and for other vital processes.

From experience we know that in cold weather we are more hungry than in summer, that exercise increases the appetite, that a large man requires more food than a small child and an old person less than a young adult. Climate, activity, surface area and age are the important factors modifying the energy needs of the body.

The appetite is a rough guide to how much to eat but appetite is partly artificial; it is regulated by habit and other factors and not solely by physiological needs. We are accustomed to eat at certain hours whether hungry or no: delicious foods tempt us to eat too much and dull foods too little: worry or over-tiredness takes away all appetite.

A grown-up person can check the reliability of the appetite as a guide by periodical weighings, say twice a year. *If losing weight,* either too little food is taken in proportion to the energy expenditure and the body is burning its own substance to supply its demands for fuel, or the diet is not suitably composed, or there is some wasting disease. *If increasing in weight,* food intake is in excess of energy output.

The healthiest people do not gain in weight after they are fully developed physically. Records of 2,000,000 insured persons show that at the age of 45 " the best lives " are in the group 20 lb. *under* the average weight for that age. Penny-in-the-slot weighing machines give tables of average weight for height at different ages and allow for an increase of 20 lb. between the ages of 20 and 50. The average middle-aged person has thus a 20 lb. burden of surplus fat which is not only ugly and awkward but a danger signal. Life Insurance statistics collected from many countries connect the development of diabetes, cancer, apoplexy and chronic diseases of the heart, liver and kidney with a history of *over-nutrition.* From these data it has been deduced that the weight of a healthy adult does not exceed 2 lb. to each inch of height.

For the ordinary individual no elaborate calculations of the total daily quantity of food are necessary but merely this check by periodic half-yearly weighings to make sure that food intake and energy output are approximately equal. The increment of 20 lb. of fat in 30 years is at the almost imperceptible rate of less than 1 oz. a month. A very slight reduction in the total daily amount of food will restore the balance and prevent over-nutrition.

In family life periodic weighings for both adults and children indicate if the food intake is at the right level. Growing children normally increase in both weight and height. Slow growth in height and increasing weight suggest that the diet is more than ample in fuel but lacks good quality protein or is short of some vitamins or mineral salts essential for growth. Growth in height with loss of weight shows, either that the total fuel value is less than the energy output or that the diet is not suitably composed.

In catering for a larger number of people than the family if the supply of food is not *ad lib.*, but restricted in amount and unsupplemented, it is important that the composition of the diet should be based on calculated requirements, not only as to total quantity but as to the proportion of the various constituents.

By means of a **calorimeter,** a specially fitted enclosed chamber in which a man can sleep or exercise, physiologists have measured exactly the body's output of heat in a given time under various conditions of work and of temperature. The daily amount of food required to replace the energy spent in the form of work and heat can be estimated.

The unit for measuring the energy or fuel value of food is a **large Calorie,**[1] that is the amount of heat required to raise the temperature of 1 kilogram of water 1° C. The harder the work, the colder the temperature and the larger the surface area of the body, the more food calories are needed.

---

[1] Spelled with a capital C to distinguish from a small calorie. Large Calories are now often called kilo-calories.

1 oz. Protein	on combustion	yields	116	Calories.
1 gram ,,	,,	,,	4.1	,,
1 oz. Carbohydrate	,,	,,	116	,,
1 gram ,,	,,	,,	4.1	,,
1 oz. Fat	,,	,,	263	,,
1 gram ,,	,,	,,	9.3	,,

Fat has roughly twice the fuel value of protein or carbohydrate.

Chemical analyses, as represented in the coloured Charts, give the percentage amounts of protein, fat and carbohydrate in typical samples of common foodstuffs. Using the analyses in conjunction with the above figures the Calorie value can be calculated for any foodstuff.

For example. Supposing the analysis of a food is Protein 16 per cent. Fat 18 per cent. Carbohydrate 15 per cent.

In 1 lb. of this foodstuff the Protein is 0.16 lb.
Fat is 0.18 lb.
Carbohydrate is 0.15 lb.

which is more conveniently expressed as :

Protein ...	2.56 oz.
Fat ...	2.88 oz.
Carbohydrate	2.4 oz.

The Calorie value of 1 lb. of this foodstuff is

Protein	(2.56 × 116)	= 297 Calories
Fat	(2.88 × 263)	= 757 ,,
Carbohydrate	(2.4 × 116)	= 278 ,,
A total of ...		1,332 Calories from 1 lb. of the foodstuff.

This calculation is only to show the method by which the Calorie value of any food is calculated. In the coloured charts of food analyses the Calorie values are given for 1 oz. and for 100 gram quantities. In Table 7 the Calorie value per 1 lb. of common foodstuffs is given. Tables 6 and 7 show the comparative energy value of some common foodstuffs (pp. 138 and 139).

Knowing the quantities of different foodstuffs consumed per person per day or per week the Calorie value of the day's or the week's food can be reckoned and checked against the estimated requirements.

The actual energy requirements as estimated by the calorimeter are as follows :

A sleeping man of average height and weight (70 kg. or 154 lb.) burns fuel at the rate of 65 to 70 Calories per hour=1560 to 1680 Calories per day. This lowest level of energy output is called the **Basal Metabolism,** which is roughly 1700 Calories per day.

Sitting up the man requires 100 Calories per hour.

Light exercise takes about 170 Calories per hour.

Strenuous exercise demands from 250 to 300 or more Calories per hour.

An average day may be spent as follows :

8 hours asleep uses 8 × 65 = 520 Calories.
6 hours sitting uses 6 × 100 = 600 ,,
7 hours light work uses 7 × 170 =1,190 ,,
3 hours hard work uses 3 × 300 = 900 ,,

Day's energy expenditure =3,210 ,,

Allowing for waste in preparation and at meals the day's food as purchased should have a Calorie value of approximately 3,400 for a man of average height and weight (11 stone), doing moderate work and living in a temperate climate. In hot countries only about 2,500 Calories per day are required. In arctic regions, or if there is prodigious exertion 7,000 or more Calories may be needed.

A woman requires only 0.83 of a man's ration, that is she needs 2,800 Calories to a man's 3,400 per day. The League of Nations' Standard (1937) makes no difference between the sexes and allows 2,400 calories for an adult for a day of no work. Supplements are calculated for hours of work according to its hardness up to a total of 4,500 calories a day for very hard work. A pregnant woman requires the same as a man and a nursing mother needs 1.25 Man Value, the same as an adolescent boy.

For a family or community of different ages the Calorie requirements are calculated in terms of "**Man Value**" = 3,400 Calories. The relative Calorie requirements of the two sexes at different ages and under either active or sedentary conditions are set out in Table 1 (p. 132).

Thus a family consisting of six persons, as follows, have a total Man Value of 5 and require 3,400 × 5 Calories daily.

Grandmother	0.7 Man Value
Father	1.0
Mother	0.83
Boy aged 16	1.25
Child aged 10	0.8
Child aged 2½	0.42
	5.0 = Total Man Value for these six persons.

By means of these Man Value co-efficients the Calorie requirements can be calculated for rationing a school, institution or a nation.

The Man Value coefficients at different ages in Table 1 are a combination of the values of Cathcart and Murray combined with the observations of Gephart and Emmett Holt. They conform closely with the theoretical optimum as calculated from physiological data. They are higher for boys and girls age 14 to 18 than the co-efficients in general use by Cathcart and Murray who allow for no youthful outburst of energy and expect adolescents of both sexes to be as staid and effort-saving as their parents. Data of the food consumption of boys and girls of 13 to 18 allowed to satisfy their appetites without restriction show that there is a peak consumption of Calories rising well above Man Value. The word *peak* is used because the curve of unrestricted Calorie consumption climbs steeply at puberty and at about 18 to 20 years drops to normal adult values.

From a careful study of several hundreds of American school children, Gephart found that the average unrestricted food consumption

for boys age 13½ was 4,949 Calories per day.
,, 14½ ,, 5,126 ,, ,,
,, 16 ,, 4,997 ,, ,,

The boys consumed half as much again as a farm labourer. Emmett Holt from his records gives a peak consumption of over 4,000 Calories per day for boys age 16 to 17. His peak consumption for girls comes two years younger.

An English nutrition committee[1] investigating the dietary requirement of children at preparatory schools approached the question of total Calories from the theoretical standpoint. Their calculations were based on the average Basal Metabolism at different ages. Knowing the number of hours spent in sleep, sitting at lessons and at active exercise, it was calculated that children from 6 to 13 years need between 2,460 and 4,500 Calories a day. They did not deal with the later years of peak consumption which would presumably run from 4,500 to 5,000 Calories a day in accordance with the American figures.

---

[1] Report on Diet Requirements of Children published by the New Health Society, 1927.

Without calculating Calories we know from observation in any family that healthy boys and girls in their 'teens have ravenous appetites and will if allowed eat far more than their parents. The automatic drop in the quantity of food eaten after the ages of 17 to 18 indicates that the ravenous period is normal and physiological, partly accounted for by physical growth but mainly due to the superabundant energy, the *joie de vivre*, which is so characteristic of this period. " Lack of appreciation of this factor, or lack of provision for it, are the probable causes of much of the under-nutrition seen in children of school age." (Graham Lusk.)

Cathcart and Murray's low Man Value co-efficients for adolescents are based on actual consumption mainly in working class families in which life is drab, the money available for food limited and the nutritional level definitely sub-normal.

Diets of Low Energy Value

By a prolonged low level of nutrition and without much vigorous open-air exercise Basal Metabolism becomes sub-normal.

Poverty, illness, war and other conditions may necessitate a reduction in the energy value of the diet for a prolonged period. Initial discomfort and loss of weight are followed by adaptation to a new low level of basal metabolism. A man accustomed to an intake of 3,400 Calories a day can after a while adapt himself to a drop of 1,000 Calories a day without feeling much the worse provided that the diet conforms to the Square Meal standard. For those who are normally over-hearty eaters a certain amount of enforced tightening of the belt may be all to the good. War-time restrictions led to a decrease in cancer and diabetes, which are associated with over-nutrition.

In 1918 at the end of the war in parts of Central Europe diets were as low as 1,600 Calories, that is down to the level of normal basal metabolism. On these low diets the people were listless and apathetic and spent much time in bed to keep warm.

COMPOSITION OF THE DIET

THE old **Standard Diet** had no scientific basis but was derived from the average composition of passably efficient diets actually eaten in various countries by large numbers of people. Deductions drawn from the dietary habits of communities may not be the physiological ideal but were adopted as a Standard because these food customs represented the average practice of millions of people. This diet was composed of :

100	grams	(3½ oz.[1])	Protein yielding	410	Calories.	
100	,,	(3½ oz.)	Fat ,,	930	,,	
from 400	,,	(16½ oz.)	Carbohydrate ,,	1,640	,,	
				2,980	,,	per day.
to 300	,,	3½ oz. extra Carbohydrate yielding		410	,,	,,
				3,390	,,	,,

or approximately 3,400 Calories per Man Value per day.

The revised figures put forward by the League of Nations Committee (1937) were :

Protein	68 to 83 g.
Fat	80 to 120 g.
Carbohydrate	an elastic reserve according to output of work.

The proportions can be varied within wide limits without ill effect. Protein not only serves as fuel but is the chief structural material for growth and repair and nothing can replace it. Since protein foods are the most costly it becomes for economic reasons important to know the *minimum* protein requirements and these will be specially considered later.

Fat and carbohydrate are purely fuel and to a certain extent interchangeable. Carbohydrate can be converted into fat in the body and stored as a reserve of fuel. Fat is a concentrated fuel and carbohydrate as the sole fuel food is too bulky. A mixture is therefore convenient. Carbohydrate alone is burned too quickly. A carbohydrate meal of porridge or cereals with sugar, or of bread and jam, satisfying at the time, after about 1½ hours leaves a feeling of emptiness. Cream with cereal, or butter with bread, or bread fried in dripping, make a mixture which is more slowly absorbed and more slowly burned and thus has a longer staying power.

---

[1] Ounces are too gross a measure for estimating the protein, fat and carbohydrate values of diets and for this reason it is more convenient to work in grams. Table 7 gives the grams of protein, fat and carbohydrate and the Calorie values of 1 lb. of common foodstuffs.

The gram values of the Standard Diet work out neatly at 1:1:4, that is 1 Protein to 1 Fat to 4 Carbohydrate.

As much as 150 g. of fat a day can be absorbed without difficulty. If however the amount of carbohydrate is cut too low and fat increased too high, *auto-intoxication*, or biliousness, may be caused by the poisonous products of fat incompletely burned in the body. Fat is slowly assimilated and incompletely burned unless admixed with carbohydrate in suitable proportions. Rapidly digested and quickly absorbed, carbohydrate assists the combustion of fat both in speed and completeness.

Changing Food Habits

Data of family diets at all levels of income from unemployed to professional classes in Cardiff, Reading and St. Andrews[1] indicate that a change of food habits and of ratios is in progress. Less protein and more fat are now eaten. Even amongst the very poor the percentage of Calories supplied by fat is much higher than expected and as the income rises the tendency is to provide still more fat and only a little more protein. (See Chart 26.)

This increased consumption of fat by augmenting the supply of vitamins A and D may assist in the prevention of rickets, tuberculosis and other diseases associated with a shortage of fat-soluble vitamins. Up to 150 g. a day the increase in fat may be beneficial but it is doubtful if the 183 g. in the diet of the professional class (Chart 26, Diet V) would all be absorbed, and there seems to be no advantage in pushing the fat so high. One part of fat to four of carbohydrate is a satisfactory proportion.

In the last twenty-five years the consumption of starchy foods

---

[1] Cathcart and Murray. "Studies in Nutrition," Medical Research Council Reports. Numbers 151 and 165.

(bread, cereals and potatoes) has steadily declined. Mechanized labour and transport and the central heating of buildings have reduced the nation's energy output and stodgy foods are no longer wanted. At the same time an ever increasing proportion of carbohydrate is taken as sugar in one form or another. In thirty years in England the sugar consumption has doubled. An ingenious method for utilizing surplus stocks of cereal is the conversion of corn starch into the sugar *glucose* and including vitamin D. Such mixtures are extensively advertised as banishing fatigue and providing unbounded energy and the sunshine vitamin, which sounds very attractive to jaded town dwellers. Unfortunately vitamin D is the only one known to be harmful if taken in excess and the public already eats much too much sugar. More hopeful from the health point of view is the multiplication of milk bars. Although the sale of dairy products is steadily growing, less milk is drunk per head in Great Britain than in many other European countries. The consumption of bananas is 200 per cent. more than before 1914 and that of citrus fruits 96 per cent. higher.

In the United States changing dietary habits are also recorded. During the last twenty years the consumption of maize has decreased by 64 per cent. and wheat by 20 per cent. while sugar increased by over 70 per cent. Apart from its sugar sins the United States are far more vitamin-wise in their habits than Great Britain. The growing popularity of salads and the use of vegetable oils as dressing accounts for a 30 per cent. increase of fats and oils. Fruits and vegetables are eaten in much larger quantities. As a result of education more wholemeal and less white bread are eaten and the packers of breakfast cereals are utilizing the germ and bran. The consumption of milk and cheese has increased while that of meat remains about the same, less beef and more veal and pork are eaten.

THE DAILY QUANTITY OF PROTEIN

THE daily allowance of protein 100 g. or 3½ oz. in the old Standard Diet was derived from statistics of food consumption of people of many countries on freely chosen diets. Repeated attempts with conflicting results have been made to fix an absolute physiological minimum. The Stiebeling standard (U.S.A. 1933) allows 68 grams total protein a day per head of the population allotted as follows:

45 g. for children under 4 years.
55 to 75 g. for older children.
67 g. for men.
75 g. for women.

Some of the virtue which was attributed to protein has been found to be inherent in the vitamins and not in the protein of such foods as flesh, eggs, cheese, milk and seeds. All proteins were assumed to be of equal value. Now we know the *quality* of the protein is as important as the *quantity* and the quality varies. Further we have to distinguish between the two uses of protein, the irreducible minimum needed as structural material for growth and repair and the proportion which will be used as fuel. The minimum obviously must not be less than the amount required for growth and repair and for this smaller amounts of complete proteins will suffice than of mixtures of incomplete proteins which may not exactly supplement each other's deficiencies. Any quantity in excess of that wanted for structural purposes is utilized as fuel. As a fuel food protein is much more expensive than fat or carbohydrate and it is extravagant to use protein as fuel. In luxury hotels and restaurants protein largely replaces carbohydrate and fat as fuel. A large proportion of protein in the diet is more easily dealt with by the young and active than by the sedentary and middle-aged. For the young protein generosity is a factor of safety, in adult life it may be a danger.

The wartime (1914–18) daily protein ration for civilians in

England as advocated by the Food Committee of the Royal Society was 70 g. per head, of which approximately half, that is about 35 g., was animal protein. This corresponds with the recommendation of the League of Nations Health Committee (1935) of not less than 1 g. protein per kilogram of body weight as the amount for adults, that is 70 g. protein daily for a man of average weight. For pregnant and nursing women 1.5 g. to 2 g., and for infants 3.5 g. protein is allowed daily per kilo. of body weight. The Ministry of Health in their Memorandum *The Criticism and Improvement of Diets* (1934), fixed 37 g. animal protein as the *minimum* for adults. This figure is based on milk protein which is of exceptionally high biological value and the objection has been made that this quantity might be too low if derived from meat and fish. The Army standard peace-time ration allows 63 g. animal protein a day. This is very high as compared with the Stiebeling allowance of 67 g. total protein for a man, but for the reconditioning of young recruits from poor homes a high protein ration may be beneficial. The British Medical Association Committee on Nutrition in their Report (1933) advise that a figure intermediate between 37 g. and 63 g. should be adopted and suggest 50 g. of First Class (i.e., animal) protein per day as the *minimum* for adults.

In planning a diet it is not so much a question of a fixed daily quantity as an amount of protein proportionate to the total food. Satisfactory ratios of the three main constituents are :

⅙ Protein ⅙ Fat ⅔ Carbohydrate.

In the infant's diet of human milk the ratios are :

⅙ Protein ⅓ Fat ½ Carbohydrate.

In both cases the protein ratio is ⅙ with the significant difference that the *whole* of the infant's ration is *animal* protein.

Throughout the entire period of growth it is advantageous to keep a high ratio of animal protein. On weaning the child should not suddenly be overwhelmed with starchy food.

Neither in home life nor in boarding schools is the supply of protein apportioned as it should be. In Cathcart and Murray's *Studies in Nutrition*,[1] an analysis of distribution of food within the family showed that both in respect of total Calories and of protein Father took more than his just Man Value and Mother got only 0.7 instead of the 0.83 Man Value to which she is entitled and which she cannot safely forego during pregnancy or lactation. It is not surprising that working-class women suffer from nutritional anæmia. The redistribution of the food in more physiological proportions between husband and wife might lessen maternal mortality. In order that Father may surfeit the children also go short and the figures show their allowance of carbohydrate is too high and that of protein and fat too low.

---

[1] Medical Research Council. Special Report Series, Nos. 151 and 165 (H.M.'s Stationery Office).

Many years ago certain medical specialists in child welfare advised that in feeding children we should learn "to think nitrogeneously," that is in terms of protein. Even in middle-class families who can afford proper food there is a tendency to satisfy the appetite of children with sugar and starch and to give them proportionately less protein than to the grown-up members of the family. A similar distribution is made in boarding schools. The adult staff who need less protein are fed on a definitely higher protein scale than the growing children.

Intimately associated with the question of the quality of protein is the problem of vegetarianism.

Vegetarianism has been defined by its adherents as "the practice of living on the products of the vegetable kingdom, *with* or *without* the addition of eggs, and of milk and its products, to the exclusion of fish, flesh and fowl."

The motives for this limitation of the diet are the attainment of ideal health and physical efficiency, or an æsthetic distaste for feeding on the corpses of animals, or the avoidance for humane reasons of animal suffering and slaughter. To be consistent, if the latter is the predominant motive, eggs and milk should be excluded from the diet. The provision of these female products at a reasonable price entails the slaughter and sale of the supernumerary male animals as food. An egg and milk vegetarianism on a national scale, however desirable for health or other reasons, seems to be an economic impracticability until such time as breeders can control the determination of sex. If the virtue of vegetarianism is to be freed from dependency on the flesh-eating habits of the majority of the population a vegetarian diet must be of plant food only. Such a restricted diet has difficulties and dangers and from time to time we read in the newspapers of the death from inanition of some strict vegetarian or fruitarian.

Plant materials in general consist largely of water and contain insoluble fibre. To provide enough fuel and all the essential amino acids, plant food has to be consumed in a larger quantity than is always comfortable for the human digestive tract. Nuts, pulses and the seeds of cereals are dry concentrated foods but on cooking to make them more digestible the seeds absorb water and increase in bulk.

At present the only tests for the nutritive adequacy of mixtures of plant proteins are purely empirical. In practice one combination may succeed and another fail to maintain health. A leaf and seed mixture is usually satisfactory.

A diet of low protein content, or solely of plant material, is advantageous only if rightly chosen. Disaster is inevitable if the protein is reduced by the simple process of cutting out flesh, fish, eggs and milk from the ordinary diet, leaving white cereals, margarine and sugar as the chief fuel foods. A diet thus curtailed and unbalanced has in this country been held responsible for the development of certain cases of melancholia and mental instability, and in U.S.A. similar diets are associated with the insanity which is a common preliminary to pellagra. Vegetarians have empirically recognized the necessity for wholemeal cereals and other whole seeds, and an abundance of vegetables ; the majority include also milk and eggs.

THE DAILY QUANTITY OF MINERALS

THE relative calcium, phosphorus and iron content of food is shown in Table 8. It is not always essential to calculate the exact quantity of each mineral salt. A diet which supplies vitamins and a suitable protein allowance will rarely be deficient in minerals. The advice of the American dietician, E. V. McCollum, to mix *leaf and seed* holds good for the provision of mineral salts as well as of vitamins and proteins. But the seeds must be the entire seed product and the leaf unspoiled. Valuable salts are removed in the milling of cereals and some minerals are lost if vegetables are cooked in an excess of water and the water is thrown away.

The values in Table 8 are average figures. Minerals in foods vary greatly according to the minerals in the soil and other factors. For instance some samples of oatmeal may contain more iron than lentils. Different parts of the same food vary : in cabbages the calcium salts are concentrated in the outer leaves.

Milk is especially good for the formation of bones and teeth. One pint supplies 0.8 grams of calcium and 0.6 grams of phosphorus. One quart of milk a day is the amount recommended for older children and women.

Animal foods except for cheese and milk are poor in calcium but rich in phosphorus. Small fish (sardines, brisling, sprats and whitebait), of which most of the bones are eaten are particularly good for both calcium and phosphorus and coming from the sea provide iodine also.

Iron is supplied by meat, some dried fruits, berries such as raspberries, oatmeal, barley and whole cereals *but not by milk.* Traces of manganese and copper are needed and these minerals generally run parallel with iron values. Only quite small amounts of magnesium are wanted and it is present in green foods.

Sulphur is derived from protein and if protein is correct in amount so also will be sulphur.

Potassium is contained especially in green leaves and plant tissues parallel to the calcium content.

Sodium chloride is in animal foods and is added in cooking. In all ½ to 1 oz. may be eaten daily.

The main supply of iodine comes from the sea, from fish and from vegetables grown in soil within reach of windborn spray. Fish should be eaten two or three times a week. In inland districts most of the iodine has been washed out of the soil. In Derbyshire, Central Europe and the central parts of North America iodised table salt is used.

The daily requirement for minerals has been reckoned from hundreds of analyses of the intake and output on various diets.

For the three chief minerals the daily quantities required are

	CALCIUM.		PHOSPHORUS.		IRON.	
	grams.	*grams per kilo body weight.*	*grams.*	*grams per kilo body weight.*	*milligrams.*	*milligrams per kilo body weight.*
Adult Man ...	0.68	0.01	1.3	0.02	12	
Adult Woman						
Pregnant ,,	1.0	0.02	1.6	0.03	15	
Lactating ,,	2.0	0.04	2.0		20	
Children :						
6-14 years ...	1.0	0.1	1.0	0.03		0.4 mg.
3-6 years ...	intermediate		inter-mediate			0.6 to 0.7
Babies ...	0.8	0.2	0.8			1.0 to 1.5

Note specially the increased requirements of the pregnant and lactating woman. The latter may have to draw on her own bones and teeth to supply calcium and phosphorus in her milk if there is not ample in her food.

Note also that the amounts of iron are small and measured in milligrams as compared with grams of phosphorus and calcium.

THE SUPPLY AND CONSERVATION OF VITAMINS

Now that pure vitamins or their potent concentrates are commercial products there is a tendency to regard them as the latest form of patent medicine. This is a wrong outlook. The satisfactory supply of the vitamins is a question of the proper balance of the whole diet. Many foodstuffs contain several of the vitamins and if the diet is entirely composed of foods selected from all four corners of the Square Meal chart in suitable proportions it will provide enough of all the vitamins and also of mineral salts. A guiding rule should be *no Calories without vitamins* with the exception of a little sugar or chocolate for flavouring purposes.

The amount of vitamins in most common foods has been measured in terms of international units fixed by the League of Nations Technical Commission (Health Committee). The figures given in Tables 9, 10, 11, 12 represent the *average* values. The actual value varies widely in different samples of the same kind of food. By means of these Tables it is possible to estimate approximately the vitamin content of a diet and see if it conforms to a satisfactory standard.

In order not to waste the vitamins in foodstuffs it is necessary to know the processes by which vitamins are destroyed or removed, and these are considered separately under each vitamin.

Vitamin A

The potency of vitamin A in a food is measured by its biological efficiency irrespective of whether the substance present in the food is vitamin A or its precursor *carotene* or a mixture of both carotene and vitamin A (p. 32).

It must be repeated again that the figures in Table 9 of vitamin values are the *average*, the mean values. Even in plant materials the vitamin A potency varies but in animal foodstuffs such as dairy products, body fats and liver oils the variation in value is far greater as it depends on the food of the animals.

Pure fresh fish liver oils contain so many hundred thousand units of vitamin A that they cannot be represented diagrammatically in the same table as ordinary foods. Retail fish liver oils have a much lower average value, depending on the method of preparation, age and storage. If the bottles of oil are exposed to sunlight all the vitamin A is destroyed. Norwegian cod liver oil has not as high a value as cod liver oil from Iceland, Newfoundland or Nova Scotia. Halibut liver oil is very much richer than cod liver oil in both vitamins A and D. Dog fish liver oil has much more vitamin A than cod liver oil but less vitamin D.

The body oils of the fatty fishes and therefore the flesh as we eat it, are a valuable source of vitamin A though not as rich as the liver oils. The body oils in order of merit are shark, sardine and pilchard, common eel, river lamprey, herring, halibut and salmon.

Vitamin A can be stored in the body. Summer surplus carries on to make good winter poverty. The main store of vitamin A is in the liver in the form of carotene which is converted into vitamin A as required until the reserve is exhausted. Vitamin A is also stored in the bone marrow but there is little in the flesh or body fat.

The processes of boiling, canning, drying, cold storage or the storage of fruit in ethylene chambers do not seriously lessen the vitamin A value of foods. Stored foods canned or refrigerated during summer plenty have a higher value than fresh winter produce. Loss proceeds slowly during storage. After nine months storage dried milk has about half the value of freshly dried milk. The commercial reconditioning of rancid butter, the re-pasteurization of unsold milk are processes likely to destroy vitamin A by oxidation.

This vitamin is concentrated in the outer leaves of vegetables and in the peel and skin of fruit. Hips and haws are particularly rich in this vitamin probably because there is a greater proportion of skin in small wild berries as compared with larger cultivated fruits.

Thin dark leaves such as dandelions, kale and turnip tops are very rich in this vitamin and so are the outer leaves of lettuce, cauliflower and cabbage which too often are wasted. The dense pale hearts of lettuce, cabbages and Brussels sprouts and bleached stalks of asparagus and celery contain little or no vitamin A. The outer green leaves of lettuce contain 1,400 int. units per oz. and pale leaves only 420.

How much vitamin A is required daily ?

Cows require 30 to 50 units daily per kilo. of body weight and it is probable that the human need for this vitamin is proportionate to body weight rather than to energy output.

From 2,000 to 2,500 int. units a day appears to be a satisfactory allowance for infants and from 3,000 to 4,000 for adults ; older children and nursing mothers may need from 4,000 to 6,000. The optimal intake for storage of vitamin A is fifteen times greater than the minimum so that the figures suggested are not too generous.

A diet that is well balanced and contains a proper supply of the other vitamins will provide from 4,000 to 6,000 int. units. The cheap diet (pp. 82–84) provides 4,000 and the model diet (p. 72) provides 6,000 int. units per head per day.

From the Table below we can tell roughly how much of each foodstuff is required to provide 1,000 or 500, or 100 int. units of vitamin, A and check the diet to see that it contains enough. Generosity is advisable owing to the varying values of different samples and loss through wastage.

1,000 International Units of Vitamin A are contained in :

1/13 oz.	Calf's liver.
¼ oz.	Ox liver.
½ oz.	Spinach, cooked.
¾ oz.	Dried apricots.
1¼ oz.	Ox kidney.
1¼ to 1½ oz.	Butter. Vitaminized margarine.
1½ oz.	Dried prunes, egg yolk, tomato or cheese.
2 oz.	Fresh apricots. Carrots. *Green* lettuce leaves.
4 oz.	Cabbage. Soya bean. Yellow maize.
¾ pint	Pasteurized milk (average for the year).
¼ pint	Fresh summer milk.
1¾ pint	Fresh winter milk.

500 International Units of Vitamin A in :

1¼ oz.	Watercress.
2 oz.	Cabbage.
2¼ oz.	Bone marrow.
2½ oz.	Fresh green peas.
3 oz.	Green runner beans. Dried dates.

100 International Units of Vitamin A in :

1¼ oz.	Wheat germ (" Bemax ").
2¼ oz.	Orange juice. Semolina. Middlings.
3½ oz.	Stewed gooseberries. Parsnips. Lentils.
7 oz.	Pineapple, fresh or tinned. Sardines. Bananas. Blackcurrants.

A quarter ounce of calf's liver will provide enough vitamin A for an adult for a day. Three or four ounces is a usual helping and the surplus will be stored to offset some scantier days.

Another day the 3,000 units needed by an adult can be provided by 1½ oz. butter + 1½ oz. cheese (or 1½ oz. tomato) + 2 oz. carrot.

In summer ¾ pt. milk may supply 3,000 units but it would take a lusty infant to drink the 5¾ pt. milk needed in winter to provide the necessary amount of vitamin A.

24 oz. human milk from a mother on a rich vitamin A diet supplies enough for the infant. In autumn, winter and early spring infants and children need a daily supplement of fish liver oil to provide both vitamins A and D. One drop of halibut liver oil is enough (= 3,200 int. units vitamin A) or half a teaspoonful of cod liver oil[1] (= 3,000 int. units).

Vitamin B_1

Vitamin B_1 in foods is not harmed by drying, by ordinary cooking, by freezing or canning but it is reduced in amount by cooking with alkali (e.g. sodium bicarbonate), and by heating under pressure. The most serious loss of vitamin B_1 occurs in machine-milling to make white flour, white rice, pearled barley and cornflour. The most valuable parts of the grain are removed and fed to farm stock. Preparations of bran or germ are sold at greatly enhanced prices to cure the constipation of human beings who eat white cereals and suffer from a deficiency of vitamin B_1.

---

[1] In U.S.A. the prescribed daily dose of retail preparations of cod liver oil must contain at least 6,250 Int. Units of vitamin A and 625 Int. Units of vitamin D.

Three teaspoonfuls daily of a U.S.A. cod liver oil (9,500 Int. Units of vitamin A) cured nightblindness in the majority of cases in one month.

To secure an optimum supply of this vitamin it is essential that the carbohydrate in the diet should be derived mainly from whole seed products.

How much vitamin B_1 is required daily?

Beriberi has developed on diets providing from 71 to 382 int. units of vitamin B_1 a day, about 200 being the level of the usual beriberi producing diet.

The amount needed varies according to body weight and energy metabolism. On this basis it has been calculated that the *minimal* daily requirement for an adult man of average weight consuming 3,500 Calories of food is about 550 units, for safety 600 to 700. Other estimates have assessed the optimum at from 750 to 1,300 int. units daily.

Another method of calculating is to allow 20 int. units per 100 Calories of food for an adult man, that is 700 int. units daily for a 3,500 Calorie diet.

The allowance for children is 40 int. units per 100 Calories of food. An infant receiving 600 Calories of food a day requires 240 int. units. An older child taking 2,000 food Calories needs 800 int. units daily, that is 100 units a day more than the average man.

During pregnancy and lactation women require from 900 to 1,500 units daily, the greater amount during lactation.

In the treatment of prolonged fevers and other conditions in which the energy metabolism is increased, more than the normal amount of vitamin B_1 is required, up to 1,500 units.

The amount required for health is far in excess of that which merely protects from beriberi. The above figures for optimal requirements cannot be regarded as absurdly high or impossible to attain because before the introduction of roller milling the food of even the poorest classes provided over 1,000 units daily.[1] The consumption of impoverished cereals together with an excessive amount of sugar have reduced the vitamin B_1 content of the diet to one-quarter of what it was. In fact the League of Nations Committee (1937) appears to have taken as their standard of vitamin B_1 supply the amount that is generally eaten rather than the amount which is desirable and suggest as the daily intake only 10 int. units per 100 Calories of food. This works out at the low level of 300 units for an adult on a 3,000 Calorie diet and is dangerously close to the beriberi level.

---

[1] Drummond and Wilbraham, *The Englishman's Food*, 1939.

The Provision of Vitamin B_1 in the Diet

The popular idea as to what constitutes good wholesome food is well illustrated by the diets recommended in the " Doctors' Cookery Book."[1] The Doctors' weekly budget for a working-class family of five persons includes meat, cheese, milk, fish, bread, butter, eggs, fresh fruits and vegetables. Although the book is designed "*for the women who have to get a full pennyworth of food value from every penny of their outlay*" there is no precautionary hint that much better health value for money is given by wholemeal bread and flour as compared with white bread. It is likely therefore that most families trying conscientiously to follow the Doctors' advice will buy white bread, white flour, tapioca, sago, cornflour and white rice. The total vitamin B_1 value of the Doctors' Budget for Week 1 works out at roughly 397 int. units a day. This will prevent beriberi and satisfy the low standard of the League of Nations Committee but it does not approach the optimal supply suggested by those who have made a special study of vitamin B_1 requirements.

Whole cereal products are the only cheap foods that can be eaten in large enough quantities to ensure a liberal supply of this vitamin. By changing the bread and flour from white to wholemeal in the Doctors' diet the vitamin B_1 intake is more than doubled and reaches 930 int. units. At the same time there is a parallel increase in other valuable dietary essentials (p. 95).

There is a loose dogma propounded by some dieticians. " Look after vitamins A, C and D and B will look after itself." The inaccuracy of this statement can be proved by studying the Tables 9 to 12 of vitamin values. The foods which are rich in vitamin A, D or C are not rich in vitamin B_1. It is ignorance or carelessness and not poverty which accounts for an insufficiency of this vitamin in the food at all levels of income. The less money there is to spend on food the more largely should cereals bulk in the diet, and if these are wholemeal bread, oatmeal and wheat middlings the poor will be better nourished in this respect than the rich. The cheap family diet on page 82 provides 930 int. units vitamin B_1 per head per day.

---

[1] Issued by the British Medical Association, 1936, price 4d.

To check the daily supply of this vitamin it is useful to know roughly how much of each kind of foodstuff supplies 100 units.

100 International Unit of Vitamins B_1 are contained in :

⅛ oz. Dried yeast.
⅙ oz. Yeast extract (" Marmite ").
⅕ oz. Wheat or Barley germ. " Bemax."
¾ oz. Wheat middlings. Rice bran. Germ of rye or maize.
1 oz. Wheat bran. Buckwheat. Peanut. Hazel nut. Fried bacon.
1¼ oz. Pork, lean. Whole wheat or wholemeal. Whole barley. Whole oatmeal. Natural brown rice. Malt extract.
1⅓ oz. Pig's kidney or heart.
1⅔ oz. Boiled ham, lean.
1¾ to 2 oz. Rolled oats. Millet. Dried peas, beans and lentils. Sheep's heart. Hard roe of cod.
2 oz. Almonds. Chestnuts. Haricots. Sheep's kidney or liver.
2½ oz. " Prepared breakfast " oatmeal (dry weight). Walnut.
3 oz. Canned peas.
3 to 3½ oz. Wholemeal bread.
3½ to 3¾ oz. Yolk of hen's egg. Germ bread (" Hovis "). Ox kidney. Cooked fresh green peas.
5 oz. Dried figs, prunes and raisins.
5¼ oz. Cabbage. Cress. Brussels sprouts.
5½ oz. Watercress. Spinach. Cauliflower. Beetroot. Carrot. Radish.
6 oz. Soft roe of herring. Mutton, lean flesh.
7 oz. Potato. Banana. Mushroom. Maize. Semolina.
9 oz. Orange. Tomato. Raw onion. Fish. Cooked tongue. Lean beef.
14 to 15 oz. Turnip. Canned tomato. Stewed onions. Runner beans, raw. Condensed milk.
20 oz. Cooked dried peas and beans. Milk. Stewed rabbit.
25 oz. or more of Cheese.
33 oz. Tripe.

To obtain an optimum supply six or more of these 100 unit portions should be eaten daily. It is impossible to eat 25 oz. of cheese or two pounds of tripe or nearly a pound of stewed onions. Foods like these which can only be eaten in $\frac{1}{4}$ or $\frac{1}{10}$ of the above portions do not contribute substantially to the day's total. Where the cost is unimportant Marmite or Bemax can make good the poverty of white bread and flour. But where every penny is precious the desirable daily allowance can only be secured by replacing white bread and cereal with whole grain products.

The Table p. 62 shows how so called " improving " process such as the manufacture of rolled oats or " prepared " breakfast oatmeal reduces the value as compared with the natural oatmeal or wheat or middlings. The cost to the consumer of much advertised packeted cereals is greater than that of the natural materials.

Nuts are good but expensive and indigestible if taken in large amounts. Pig products are surprisingly good as compared with the flesh and organs of other animals. The superiority of the pig is perhaps because this animal is fed on the germ, bran and middlings which should be eaten by human beings.

Milk is so poor in this vitamin that all bottle-fed infants, or invalids on a milk diet need a supplement of yeast extract or malt extract. When the infant is promoted to cereals it should have finely-ground whole grain sweetened with malt extract.

Vitamin B_2 Complex

This group of vitamins is in distribution very similar to that of vitamin B_1 and in the overmilling of cereals most valuable sources of supply of lactoflavin and adermin are removed. Nicotinic acid also is removed in roller milling but this loss is of less practical importance, except to vegetarians, for it is supplied by meat and fish. The red section of " The Square Meal " frontispiece shows the distribution of the three most important members of the vitamin B_2 complex. None of the members of this complex have yet been measured in terms of international units but because of its importance as preventing the disease pellagra the relative value of some of the foods supplying nicotinic acid is known. There is no nicotinic acid in maize or oats.

Quantity of Foods required to prevent pellagra.

Dried yeast	½ to 1 oz.	per man	per day.
Liver extract	3½	,,	,,
Wheat germ (after fat extracted)	5¼	,,	,,
Salmon, canned	6	,,	,,
Beef, fresh	7	,,	,,
Chicken	11	,,	,,
Haddock, Egg yolk	12	,,	,,
Whole wheat	14	,,	,,
Turnip greens	17	,,	,,
Kale	19	,,	,,
Tomato juice, or milk	1 quart	,,	,,

A diet containing 2½ cups of milk, 3 oz. fresh fruits and vegetables, and 3 oz. lean meat daily prevents pellagra with maize or oats as staple cereal.

Vitamin C

Vitamin C is measured in terms of the pure vitamin, ascorbic acid (1 mg. ascorbic acid = 20 International Units). Table 11 represents the vitamin C value in mg. ascorbic acid per oz. of material, which is fresh and raw unless otherwise described.

Vitamin C is destroyed by oxidation during the drying, ageing, overcooking or re-heating of fruits and vegetables. Citrating milk for infants or adding soda or sodium bicarbonate to green vegetables or milk is also destructive. This vitamin is washed out of vegetables prepared with excess of water.

In home-bottled fruits or home-made jam or marmalade there is no vitamin C. Commercially preserved fruits and vegetables suffer less loss by oxidation because they are prepared in bulk and often *in vacuo*. It is a pity so much excess sugar is added to canned fruits. Commercial marmalade contains from 2 to 4 mg. ascorbic acid per ounce, according to the amount of peel. The rind, peel and outer layers of fruits contain more ascorbic acid than the flesh.

Fresh fruits and vegetables differ greatly in their antiscorbutic value as shown in Table 11. Values vary greatly in different sample and varieties. For oranges, Canton, South African, Spanish sweet, Brazilian, Californian, Jaffa, bitter Spanish (Seville) is the order of merit; the Table shows the average value of orange juice. Fresh peppers include red and green varieties (capsicum, chillies, pimientos and Hungarian paprika). Peppers have the highest average value of any fresh vegetable, though their actual values range from 3 to 92 mg. ascorbic acid per ounce. Potatoes are insignificantly low in value as compared with fresh peppers, but in England potatoes are of importance because being eaten in relatively large amounts they ward off scurvy. A failure of the potato crop is followed by outbreaks of scurvy at the end of the winter. Small wild fruits like hips and haws and wild strawberries contain more ascorbic acid than the large fruits from cultivated plants and trees of the rose family, the garden strawberry, raspberry, apple, pear, plum, etc. The scarlet hips of the dog-rose are so rich in antiscorbutic that they cannot be represented on the scale used in Table 11; they contain 128 mg. ascorbic acid per ounce and hawthorn berries are about equally good. In the north of Europe where snow lies in the winter, the prevention of scurvy is always a problem. Traditionally rose hips were valued for cleansing the blood and now a concentrated preparation of hip berries is incorporated in a sweetmeat and used in Scandinavia as an antiscorbutic.

Wild fruits and leaves are also richer in vitamin A than those of cultivated plants. A salad of dandelion leaves has three to four times the antiscorbutic value of lettuce.

Dried black tea contains no ascorbic acid but there is said to be 30 mg. per oz. in dried green tea. This explains the old records that sailors on long voyages to the East were free from scurvy on the homeward journey if, instead of spending their money on alcohol, they bought green tea to drink on board ship.

The flesh of animals except goat's flesh contains little vitamin C but there is a considerable amount in the internal organs, especially the liver.

Cows' milk and hens' eggs contain a negligible amount of vitamin C as calves and chicks do not need to have this vitamin supplied in their food.

How much Vitamin C (ascorbic acid) is required daily

Twenty-five to thirty milligrams a day of ascorbic acid protect an adult man from scurvy but are not enough for proper nutrition. A better allowance is 60 mg. ascorbic acid daily for a man and more for a pregnant or nursing mother. Dietary studies in the

United States show that a diet well composed in respect to other essentials contains about 75 mg. ascorbic acid.

The vitamin C intake of a breast-fed infant is said to be about 40 to 50 mg. ascorbic acid a day for the first few weeks of life, that is about 6 to 7 mg. per lb. of body weight. In children of pre-school age the maximum retention of vitamin C in the body occurs when the food contains 7.5 mg. per kilo. of body weight.

Since the amount of this vitamin in cow's milk is so small bottle-fed infants need a supplement of at least 30 mg. ascorbic acid a day. Many infants having orange juice daily do not receive nearly enough and are in a state of what is called "incipient" scurvy. From the Table below it is clear that 2 oz. orange or swede juice are needed daily and allowance must be made for spilling if fed by spoon.

It is convenient to know the average portions of foods which will provide 30 mg. ascorbic acid. One such portion will protect an adult from scurvy and two portions or four ½ portions are desirable for health; for a nursing mother the equivalent of three or four portions should be taken.

30 mg. Ascorbic Acid are contained in:

	oz.
Black currants, parsley, fresh peppers	¾
Brussels sprouts, raw ...	1
Horseradish, turnip greens, raw; wild strawberries ...	1¼
Spinach, raw; brocolli, raw	1½
Cabbage, raw	1¾
Lemon juice, orange juice, strawberries, asparagus tips, raw; watercress, cauliflower, raw	2
Swede turnip, raw	2¼
Grapefruit, red currants ...	2½
Chestnuts	2¾
Gooseberries, ox liver ...	3
Loganberries, kale, calf's liver	3½
Raspberries, pineapple, tangerine, broad beans, raw ...	3¾
Dandelion leaves, garlic, pig's liver	4½
Tomatos, parsnips, green peas, leeks, new potatoes, chicken's liver	5
Cabbage boiled half hour, no soda	5½
Cooked swedes, rhubarb, raw	6
Radish, aubergine	7½
Old potatoes	10

The most useful antiscorbutics are those which contain 30 mg. ascorbic acid in less than 4 oz. of the food. Potatoes are useful because they can be eaten in larger quantities.

The above Table shows how much value cabbage and swedes lose on cooking. 3 oz. of cabbage boiled for ½ hr. equals about 1 oz fresh material. Spinach, and other greens suffer similar loss on cooking and all value is destroyed if soda is added to the cookin water.

Boiled potatoes lose 25 per cent. or more of vitamin C on boilin as compared with a 10 per cent. loss if boiled in their skins. Ther is practically no loss if potatoes are steamed without peeling.

In cauliflowers and carrots ascorbic acid is partly combine with protein and is liberated on heating. Cooked cauliflower an carrots actually have a higher vitamin value than the ra material.

After gathering green vegetables deteriorate very rapidly an have no value when dried. Fruits lose value much more slowl than green stuff during storage and cooking.

Vitamin D is very similar in distribution to vitamin A but i stored in the liver and eggs and not in the flesh of animals and i not in green vegetables. It is not destroyed by drying, heating canning or freezing but is destroyed by too long irradiation wit sunlight or ultra-violet rays. *Ergosterol* the precursor of vitamin D is not easily destroyed. It is present in small traces in number of foodstuffs ; abundantly in yeast, but not in yeas extract.

It is not possible to represent the vitamin D values of oils an foods diagrammatically, as will be seen from the wide range values in the numerical Table 12 (p. 150).

How much vitamin D is required daily ?

This question cannot be answered exactly as the need vari with the available sunlight, with the ergosterol and the amoun and proportions of soluble phosphorus and calcium salts in th food. In the skin of people and animals exposed to sunlig inactive ergosterol becomes active vitamin D and less of the vitamin is required in the food. The ergosterol value of foods ha not yet been ascertained.

The chief function of vitamin D is to control the absorptio utilization and excretion of calcium salts and phosphorus salt It ensures the normal deposition of calcium phosphate in th bones and teeth and hence the name *calciferol* for the pu vitamin. Infants, children, nursing and pregnant mothers ha

United States show that a diet well composed in respect to other essentials contains about 75 mg. ascorbic acid.

The vitamin C intake of a breast-fed infant is said to be about 40 to 50 mg. ascorbic acid a day for the first few weeks of life, that is about 6 to 7 mg. per lb. of body weight. In children of pre-school age the maximum retention of vitamin C in the body occurs when the food contains 7.5 mg. per kilo. of body weight.

Since the amount of this vitamin in cow's milk is so small bottle-fed infants need a supplement of at least 30 mg. ascorbic acid a day. Many infants having orange juice daily do not receive nearly enough and are in a state of what is called "incipient" scurvy. From the Table below it is clear that 2 oz. orange or swede juice are needed daily and allowance must be made for spilling if fed by spoon.

It is convenient to know the average portions of foods which will provide 30 mg. ascorbic acid. One such portion will protect an adult from scurvy and two portions or four ½ portions are desirable for health; for a nursing mother the equivalent of three or four portions should be taken.

30 mg. Ascorbic Acid are contained in:

	oz.		*oz.*
Black currants, parsley, fresh peppers	¾	Gooseberries, ox liver ...	3
Brussels sprouts, raw ...	1	Loganberries, kale, calf's liver	3½
Horseradish, turnip greens, raw; wild strawberries ...	1¼	Raspberries, pineapple, tangerine, broad beans, raw ...	3¾
Spinach, raw; brocolli, raw	1½	Dandelion leaves, garlic, pig's liver	4½
Cabbage, raw	1¾	Tomatos, parsnips, green peas, leeks, new potatoes, chicken's liver	5
Lemon juice, orange juice, strawberries, asparagus tips, raw; watercress, cauliflower, raw	2	Cabbage boiled half hour, no soda	5½
Swede turnip, raw	2¼	Cooked swedes, rhubarb, raw	6
Grapefruit, red currants ...	2½	Radish, aubergine	7½
Chestnuts	2¾	Old potatoes	10

The most useful antiscorbutics are those which contain 30 mg. ascorbic acid in less than 4 oz. of the food. Potatoes are useful because they can be eaten in larger quantities.

The above Table shows how much value cabbage and swedes lose on cooking. 3 oz. of cabbage boiled for ½ hr. equals about 1 oz fresh material. Spinach, and other greens suffer similar loss on cooking and all value is destroyed if soda is added to the cooking water.

Boiled potatoes lose 25 per cent. or more of vitamin C on boiling as compared with a 10 per cent. loss if boiled in their skins. There is practically no loss if potatoes are steamed without peeling.

In cauliflowers and carrots ascorbic acid is partly combined with protein and is liberated on heating. Cooked cauliflower and carrots actually have a higher vitamin value than the raw material.

After gathering green vegetables deteriorate very rapidly and have no value when dried. Fruits lose value much more slowly than green stuff during storage and cooking.

Vitamin D is very similar in distribution to vitamin A but is stored in the liver and eggs and not in the flesh of animals and is not in green vegetables. It is not destroyed by drying, heating, canning or freezing but is destroyed by too long irradiation with sunlight or ultra-violet rays. *Ergosterol* the precursor of vitamin D is not easily destroyed. It is present in small traces in a number of foodstuffs; abundantly in yeast, but not in yeast extract.

It is not possible to represent the vitamin D values of oils and foods diagrammatically, as will be seen from the wide range of values in the numerical Table 12 (p. 150).

How much vitamin D is required daily ?

This question cannot be answered exactly as the need varies with the available sunlight, with the ergosterol and the amounts and proportions of soluble phosphorus and calcium salts in the food. In the skin of people and animals exposed to sunlight inactive ergosterol becomes active vitamin D and less of the vitamin is required in the food. The ergosterol value of foods has not yet been ascertained.

The chief function of vitamin D is to control the absorption, utilization and excretion of calcium salts and phosphorus salts. It ensures the normal deposition of calcium phosphate in the bones and teeth and hence the name *calciferol* for the pure vitamin. Infants, children, nursing and pregnant mothers have thus special need for this vitamin. Provided the food contains calcium and phosphorus in suitable amounts relatively little vitamin D is needed. Rickets develops when there is too little phosphorus or too little calcium in the blood. Vitamin D adjusts an incorrect balance of these minerals by regulating their excretion. The more lop-sided is the mineral balance of the food, the more vitamin D is required to correct it.

The League of Nations Committee advises at least 150 int. units daily and 400 to 500 for full growth and vigour. The League figures are low as compared with those generally advised. Rickets has developed in diets containing up to 675 int. units daily and a safer level is that recommended by Dr. Leslie Harris[1].

To prevent rickets	...	1,500 int. units per infant per day.
To cure rickets	...	3,000 ,, ,, ,, ,, ,, ,,
Harmful overdose	...	10,000 ,, ,, ,, ,, ,, ,,

Assuming some vitamin D is provided by the food a suitable supplement for child or mother is 500 to 1,000 int. units a day as contained in $\frac{1}{18}$ to $\frac{1}{9}$ teaspoons of halibut liver oil, or 1 to 2 teaspoonfuls of cod liver oil. For infant feeding the calculated amount of vitamin units is already included by the makers in some dried milk preparations and no more need be added.

This is the only vitamin known to be harmful if taken in excess of the actual needs. Excess leads to calcification of soft tissues and causes hardening of the arteries and deposits of stone in kidneys and other internal organs. It is also the most easy vitamin to take in excess of actual requirements since the public can buy a variety of preparations containing the pure vitamin or potent concentrates prepared from fish oils or irradiated yeast. Glucose with added vitamin D now has a large sale (p. 49). The promiscuous consumption of this vitamin may do more harm than good especially to the elderly. There is no risk of overdosage if the supply is derived from natural foods and sunshine in summer, supplemented in winter by fish liver oil. In this way other valuable food substances are obtained which are not included in the artificial preparations.

[1] *Vitamins in Theory and Practice.* Cambridge University Press.

A TYPICAL DAY'S FOOD FOR AN ADULT

We are now in a position to criticize an average day's food. We can check its energy, that is Calorie value: check the proportion of protein, fat and carbohydrate; and check the adequacy of the supply of animal protein, vitamins and minerals. A typical day's food for an adult is:

Breakfast.	*Dinner.*
Porridge, Milk, Toast, Butter, Egg, Marmalade, Tea, Sugar.	Roast Mutton, Cabbage, Potatoes, Suet Roly-Poly with Jam or Syrup.
Tea.	***Supper.***
Bread, Butter, Biscuits, Tea, Sugar, Milk.	Toasted Cheese, Bread, Butter, Fruit Cake, Raw Apple.

To criticize the day's food the weight of each foodstuff consumed must be known. The Calorie value per oz. of most common foods is given in the coloured charts and the total Calorie value is easily reckoned and compared with the Man Value standard. The quantities of protein, fat and carbohydrate contained in 1 lb. of common foods and also the Calorie value per 1 lb. are given in Table 7. In estimating the composition of the food consumed the protein is subdivided into animal and plant; it is as important to know the amount of animal protein as it is to know the total protein.

			Protein			
Foodstuffs.	*Quantity*	*Calories*	*Animal*	*Plant*	*Fat*	*Carbohydrate*
½ pint milk	10*oz.*	190	0.3	—	0.35	0.5*oz.*
1 egg	2	82	0.25	—	0.2	—
¼ lb. lean mutton ...	4	172	0.8	—	0.3	—
Butter, meat fat, suet	4	920	—	—	3.5	—
Cheese	2	240	0.5	—	0.65	—
Bread	8	507	—	0.5	—	3.8
Fruit cake	3	295	—	0.1	0.3	1.7
Biscuits, plain ...	2	209	—	0.2	—	1.5
Oatmeal	1	116	—	0.1	0.1	0.7
Flour	1	104	—	0.1	—	0.7
Potatoes	10	234	—	0.2	—	1.7
Apple	4	49	—	—	—	0.4
Cabbage	4	28	—	—	—	0.2
Sugar	2	232	—	—	—	2.0
Jam and Marmalade...	2	162	—	—	—	1.4
Total	59	3,540	1.85	1.2	5.4	14.6*oz.*
			3. oz.			
		or	54	31		
Since 1 oz. = 28.4 g.			85 g.		153 g.	415 g.

In evaluating diets the last two figures in the total Calories are neglected giving in this case 3,500, a little more than 1 Man Value to allow for waste. The total protein is higher than the Stiebling standard of 68 gm. total protein. There is more than 50 gm. animal protein.

The weights of foodstuffs are given in *ounces*, the usual measure in this country. For greater accuracy in checking the quantities of protein, fat and carbohydrate these are customarily converted into *grams*: otherwise the amounts if expressed in ounces must be carried to two points of decimals which is inconvenient. Diets are therefore evaluated in *gm.* of protein, fat and carbohydrate per *oz.* or per *lb.* of foodstuff.

The fat in this typical day's food is in accordance with the changed proportions that have been recorded in the average diet in this country of late years.

The amount of carbohydrate is the same as in the Standard but the rise in the amount of fat reduces the proportion of protein from ⅙ to ⅛; the ratios being

1 of protein : 2 of fat : 5 carbohydrate,
that is ⅛ to 2/8 to ⅝

Of the total carbohydrate approximately ¼ is sugar. The proportion of sugar to starch is too high, otherwise the general composition of the diet may be passed as satisfactory for a man of average size on moderately hard work. For a boy or girl of 14 to 18 the amount of animal protein might with advantage be increased by the addition of another ½ pint of milk.

Suitable mineral salts will be supplied by the meat, cheese, milk, egg, fruit and greens, provided that on one or two days a week sea fish is substituted for the meat, egg or cheese.

With the help of Tables 9 to 13 the vitamin content of the day's food can be checked and it is approximately:

Vitamin A	5,000	Int. units.
,, D	130	,, ,,
,, C	49	mg. ascorbic acid.
,, B_1	318	Int. units (white bread and flour).
,, B_1	718	,, ,, (wholemeal ,, ,, ,,).

The amount of vitamin A is satisfactory. Vitamin D is low but can be increased on other days by alternating fresh herrings, canned salmon or sardines, or liver (preferably pig's liver) for the meat or cheese. Vitaminized margarine is worth the slight extra cost.

There is just enough vitamin C. If less than 10 oz. of potatoes and 4 oz. of cooked greens are eaten, or if the greens are spoiled by boiling them with bicarbonate of soda, the amount will be reduced. It can be brought to a better level by eating some uncooked fruit or vegetables, such as cress or an orange. Whether or no the vitamin B_1 content is satisfactory depends entirely on the kind of bread and flour as there is not enough supplied by the other foods to make good the poverty of white cereals.

The vitamin B_2 complex is supplied by meat, milk and eggs. The members of the B_2 complex and also vitamin E will be substantially increased and a better mineral mixture provided by the use of wholemeal bread.

Food for the Family

The diet for a family or institution or a nation can be evaluated in precisely the same way as for the individual if the quantities of foods consumed are known, dividing these total figures by the Man Value of the family or community as estimated by the coefficients in Table 1.

The quantities may be perfectly right on paper and wrong in practice if the adults are taking more than their fair share of first-class protein and fat (p. 52). If the quantity of animal protein has to be restricted because of cost it is more than ever important that a fair share goes to those who need it most, to the children and to the mother if she is nursing or expectant.

LARGE SCALE CATERING FOR SCHOOLS OR INSTITUTIONS

ONE way of providing for a large number of people, as for an army or a nation in wartime, is to issue rations which satisfy the physiological requirements and then leave it to the individual, or groups of individuals, to apportion the food into suitable meals. The housekeeper finds it more convenient to begin at the other end and plan menus for a day or a week in advance and order the food according to calculated quantities. It must be remembered that menus are not meals and that the food must be provided in the right quantities and proportions and fairly distributed.

Few housekeepers are so lucky as to have nothing to consider but the nutritional needs of those for whom they cater. The institutional housekeeper may have to think first of pleasing her employers by cutting the costs, of saving labour in the kitchen and pantry, of pleasing the resident staff with the pick of the food and the last consideration of all may be the nutrition of the inmates for whose benefit the institution was primarily designed. Good food may be provided and rejected by those who have acquired wrong food habits and prefer white bread, pickles and sweet stuff.

If for *adults only* the budget for the week can be made by multiplying by the required number the quantities per Man Value per day of a complete well-balanced Diet Unit such as the following :

Model Diet Unit=1 *Man Value for* 1 *Day.*	*Calories*
½ pint milk	190
1 egg *or* 4 oz. cod flesh	85
4 oz. lean meat	170
1 kipper *or* herring *or* 2 oz. cheese	240
4 oz. fat (meat fat, suet, butter, margarine)	920
18 oz. *wholemeal* bread, flour, cake, biscuit, cereal or dried pulses	1,230
2 oz. sugar (including jam, marmalade, syrup)	230
12 oz. potatoes	288
1 orange *or* 2 apples *or* 1 apple + 1 banana	35
1 raw tomato *or* green salad	10
4 oz. cabbage *or* cooked greens	22
	3,420

1 oz. meat fat is included under *fat*. Allow 5 oz. for a helping of meat. Average waste on weights as purchased is 20 per cent. for meat; 40 per cent. for whole fish ; vegetable waste variable according to kind.

The above Diet Unit provides about 54 g. animal protein per day and fat and carbohydrate in suitable proportions for adult men. If wholemeal bread and cereals are used throughout the amount of animal protein can be reduced by about 15 g. a day. Vitamins are provided on a generous scale : vitamin A 7,500 int. units ; vitamin C 110 mg. ascorbic acid ; vitamin B_1 830 int. units. The vitamin D content is always difficult to assess, but will be ample for an adult provided that fresh herring, canned salmon or other fatty fish is eaten two or three times a week.

If the institution is for children the diet has to be planned to suit their special needs. Much care and many books have been devoted to the study of the proper nutrition of infants and nursery children with consequent great reduction in infant mortality and in the incidence of rickets and scurvy. At that vitally important stage of development between the ages of 12 to 18, which includes puberty and adolescence, children are more often than not fed on a starch and sugar diluted version of the adult diet. Adolescents require a diet of higher energy value than the adult diet and with more of all the materials contributing to normal growth, that is relatively more animal protein, mineral salts and vitamins with a lesser proportion of carbohydrate.

Too much trouble and forethought cannot be given to the planning of diets for older children, especially in boarding schools in which no supplementary food is allowed.

Even in expensive boarding schools the allowance of milk, eggs, fresh fish, fresh fruit and vegetables is usually less than that which the children would receive if living at home and the quality of the food is inferior and leads to wastage. Children at school may get less first-class protein in the whole day than their parents have at one meal. The requisite total Calories in the school diet are too often obtained by padding with white bread, sugar, jam and other cheap carbohydrate stodge. Some wholemeal bread may be served but if it is stale, children prefer fresh white bread.

The school teaching staff who have finished growing are, however, fed on a definitely higher scale, supplementing the ordinary school fare both for breakfast and supper with extra animal protein and sometimes with extra butter and even cream. A schoolgirl's comment on this economical but unphysiological arrangement was "*I don't see why they* (the teaching staff) *should have such lovely food when we pay to eat and they are paid to eat.*"

Even if the supplies of essential foods, milk, fresh fish, eggs, cheese, new wholemeal bread, butter, fresh fruits and vegetables are provided *ad lib.*, school housekeepers should keep a searching check of the quantities of foodstuffs actually consumed per head per week to see that the diet departs as little as possible from the *optimum* standard for protein and vitamins as well as for energy value. Institution housekeeping is a difficult job requiring special training and much tact.

In planning a week's menus for a school there are 21 meals each of which should contain some first-class protein to the equivalent of 15 to 20 g. (see Table 3). The protein might be apportioned between the meals as follows:

Breakfast and mid-morning lunch,
1 egg (6 g.) or its equivalent + ½ pint milk (9 g.) = 15 g. animal protein.
Dinner. 4 oz. lean of meat *or* 5 oz. fish flesh = 20 g. ,, ,,
Supper. ½ pint milk (9 g.) + 1½ oz. cheese (10 g.) = 19 g. ,, ,,
Per day 54 g. ,, ,,

Children are faddy and often refuse perfectly good food and so go short of essentials. Catering on a large scale, it costs little more in time or money to provide alternative dishes and thus ensure every taste being pleased. Care must be taken to see that alternative dishes are of equivalent nutritive value. The repetition of weekly menus should be avoided. It is depressing to look forward to an inevitable cold joint, fruit tart and custard on Sunday, cottage pie on Tuesday and boiled cod on Friday.

Freshly cooked potatoes twice a day are better than bread at every meal. Potatoes can be served in such a variety of ways, but if the cook is not given definite instructions she tends to relapse into a slipshod habit of preparing them always in the same manner.

If three " Square Meals " a day are provided, the mid-morning lunch and afternoon tea become psychological rather than nutritional necessities and should consist of nothing more substantial than lemonade or fruit in summer, milk or fruit in winter. Sweet biscuits and cocoa in the middle of the morning and bread and jam at afternoon tea are the standby of the economical housekeeper because by blunting the appetite for dinner and supper the consumption of fish, meat and other expensive foods is thereby reduced; at the same time she acquires a greater reputation for liberality than if she provided three square meals and no snacks.

An Optimal Diet for Children age 13 to 18

Total Calories as calculated according to Man Value co-efficients for age, sex and activity in Table 1:

Protein total about 100 g., or about ⅙ of the whole diet.

First class (animal) protein 50 to 55 g. or $\frac{1}{12}$ of the whole diet. From 1 pint to 1 quart of milk a day should be allowed per child.

Fat 100 to 150 g. a day, that is 3½ to 5 oz.

Carbohydrate should be *not more than* ⅝ of total.

Not more than ⅛ total carbohydrate should be derived from concentrated sugar (includes jam, syrup, honey).

Mineral Salts will be suitably provided if the diet consists of milk, cheese, eggs, *wholemeal* bread and flour, fruit and greenstuff and if sea-fish is included several times a week.

Vitamins A and D will be provided if ⅓ to ⅔ of the total fat is from the good fats for these vitamins (see Yellow section frontispiece); 4 to 5 eggs a week help the supply of vitamin D. It must be remembered that animal fats in winter are in this country poor in vitamins D and A, and that vitaminized margarine and imported butter from a sunny colony have better value than fresh home produce. Green vegetables and carrots augment the amount of vitamin A. Tinned salmon and sardines supply vitamin D.

Vitamins B_1 and B_2 complex will be *optimal* in amount *only* if wholemeal bread and flour and natural brown cereals are used to the exclusion of white cereals. Liver, dried pulses, eggs, yeast extract (marmite) used for soups and gravies, and nuts maintain the supply of vitamin B_1 and also of B_2.

Vitamin C for *optimal* supply requires daily 10 to 12 oz. freshly cooked potatoes *and* a good helping of greens (not overcooked or cooked with soda) *and* 1 orange or its equivalent in fresh fruit. Fresh green salad or raw tomatoes three or more times a week.

The following list of menus and quantities of foodstuffs for a week have been modelled on the actual diet of a " high-class " girls' school in which the catering was well-planned. A few minor alterations have been made to increase the vitamin value without interfering with the cost or practicability. The unusually elaborate suppers have been simplified.

DIET FOR GIRLS' BOARDING SCHOOL (Spring Term)

	Breakfast.	*Dinner.*	*Supper.*
Day 1—	Porridge, Milk, Syrup, Sausages *or* Fried Eggs and Tomatoes, Butter, Bread.	Cold Roast Pork *or*[1] Lamb, Mashed Swedes, Boiled Potatoes, Apple and Cranberry Tart *or* Dates and Custard.	Green Pea Soup. Cold Savoury Eggs, Potato and Cress Salad, Orange Trifle *or* Fresh Fruit.
Day 2—	Cold Ham *or* Poached Eggs on Toast, Bread, Butter, Jam, Marmalade.	Irish Stew with Onions, Carrots, Barley and Potatoes, Roly-poly with Jam *or* Stewed Rhubard and Junket.	Fish and Egg Kedgeree *or* Cheese, Rye Biscuits and Butter, Cake, Fresh Fruit.
Day 3—	Porridge, Milk, Syrup, Sardines[5] *or* Fried Eggs and Fried Bread, Bread, Butter.	Roast Mutton and Onion Sauce, Greens, Roast Potatoes, Creamed Rice[2] and Prunes *or* Apple Charlotte and Custard.	Scotch Broth with Dumplings *or* Macaroni Cheese, Chocolate Custard *or* Biscuits, Fresh Fruit.
Day 4—	Fish Cakes[6] *or* Boiled Eggs, Bread, Butter, Jam *or* Marmalade.	Cold Mutton & Salad *or* Stewed Liver, Cabbage, Mashed Potatoes, Boiled Apple, Suet Pudding *or* Stewed Figs and Junket.	Savoury Rice *or* Shepherd's Pie, Lemon and Banana Jelly, Biscuits.
Day 5—	Shredded Wheat[3], Milk, Syrup, Fresh Herring *or* Kipper, Bread, Butter.	Rabbit Casserole *or* Scotch Collops[4], Cauliflower and Boiled Potatoes, Lemon Cheese Cakes or Ginger pudding.	Potato and Leek Soup, and Bread and Cheese *or* Egg and Potato Pie, Jam Sandwich Rounds and Sliced Oranges.
Day 6—	Bread and Milk *or* Grapenuts and Milk. Treacle, Fried Bacon *or* Egg, Bread, Butter.	Baked Fish, Butter Beans and Parsley Sauce, Squeezed Potatoes, Date Pudding *or* Baked Apples and Custard.	Scrambled Eggs and Tomato *or* Liver Paste, Baked Potatoes. Cake *or* Biscuits and Fresh Fruit.
Day 7—	Porridge, Milk, Syrup, Boiled Eggs, *or* Sardines, Bread, Butter.	Roast Beef, Browned Potatoes, Leeks, Yorkshire Pudding, Tinned Pineapple *or* Orange Jelly.	Fish Pie *or* Lentil Soup, with Grated Cheese Rhubarb Fool *or* Fruit Salad and Sponge Cakes.

[1] *or* denotes a choice of dishes.

[2] Made with full cream unsweetened condensed milk.

[3] *or* any breakfast cereals prepared from *whole* grain.

Every Day.

At Breakfast. Tea or coffee, hot or cold milk. If syrup or sugar are taken with porridge or cereal, bread and butter should be eaten without jam or marmalade. In summer fresh fruit can replace porridge *or* cereal but not egg *or* fish.

Mid-Morning Lunch. Milk, hot or cold. Water, lemonade or fresh fruit but no biscuits unless after physical exercises.

Afternoon Tea is best restricted to water, tea or milk and two biscuits.

Supper. Bread and butter *ad lib.* Milk or cheese should be always available and cocoa made with milk if there is not soup.

If the children are of different ages the housekeeper should ascertain each term the total Man Value, using Table 1, and then estimate the quantities of foodstuffs. Thus :

25 girls age 13 to 14 = 1.0 × 25 = 25 Man Value.
60 girls age 14 to 18 = 1.05 × 60 = 63 ,, ,,
14 adults (staff, teaching and domestic) = 0.83 × 14 = 12 ,, ,,
Total 100 ,, ,,

Quantities per Man Value	*Per Day*	*Per Week*
Calories	3,400	23,800
Animal protein (adolescent ration)	50 to 60 g.	350 to 420 g.
Fat	100 to 150 g.	700 to 1,050 g.
Carbohydrate	400 to 450 g.	2,800 to 3,150 g.

The estimation of quantities of foodstuffs to satisfy the above requirements is quite straightforward except the translation of the weights of meat and fish as purchased into terms of protein and fat eaten. The wastage of fish taking an average of equal parts of cod and herring (whole fish) is 33 to 40 per cent., that is not more than two-thirds of purchased weight will be eaten. Wastage for meat varies enormously. 2 lb. meat as purchased (average of all cuts) yields 1 lb. lean meat + 5 oz. fat. The quantity in the following budget allows for average cuts containing 15 per cent. protein and 19 per cent. fat. Some of the fat appears in the budget as dripping and suet, some will be used for frying and some wasted.

In the following budget the adult staff are allowed animal protein on the adolescent scale in excess of their requirements. It is best to leave this margin or the children may go short. The quantities of foodstuffs are given for 100 Man Value per

---

[4] Made with fresh minced meat of which a quarter might consist of ox or sheep heart.

[5] *or* tinned pilchards.

[6] Made with canned salmon in preference to white fish with plenty of potato.

week and for 1 Man Value per week so that the quantities for any number can be estimated from these figures.

WEEK'S BUDGET FOR GIRLS' BOARDING SCHOOL (Spring Term).

QUANTITIES *per* 100 M.V. per week	*Foodstuffs*	*Wt. in oz.*	*Cal.*	*Protein* *A.*	*Protein* *P.*	*Fat*	*Carbo hyd-rate*
				g.	g.	g.	g.
270 lb. as purchased	Meat, liver, rabbit, etc., *lean*. (Fat included under dripping)	22	836	127	—	39	—
12½ lb.	Sausage	2	154	6	—	10	8
12½ lb.	Bacon, streaky	2	309	6	—	31	—
125 lb. allowing for 33% waste	Fish (average of cod and herring)	14	547	70	—	28	—
13 lb.	Cheese	2	242	14	—	19	—
42 doz.	Eggs, five × 2 oz.	10	401	31	—	29	3
350 qt.	Milk, fresh 3½ qrt.	140	2646	126	—	140	189
13 lb.	Milk, condensed unsweetened	2	122	4	—	7	8
75 lb.	Butter and Margarine	12	2626	—	—	282	—
Included in Meat as purchased	Dripping, Suet	4	1022	—	—	110	—
12 lb.	Salad Oil (olive)	2	527	—	—	57	—
450 lb.	Bread, wholemeal	72	4561	—	144	4	957
62½ lb.	Biscuits	10	1281	—	26	34	209
62½ lb.	Flour, Macaroni, Cereal Custard Powder	10	1025	—	32	5	204
12½ lb.	Rice, natural brown	2	205	—	4	—	46
6¼ lb.	Barley, natural brown	1	103	—	2	—	22
25 lb.	Oatmeal	4	466	—	13	9	79
25 lb.	Dried Peas, Beans	4	377	—	23	6	65
25 lb.	Dried Fruits	4	240	—	3	—	51
75 lb.	Jam, Marmalade	12	972	—	—	—	235
94 lb.	Sugar and Syrup	15	1710	—	—	—	420
12½ lb.	Cocoa, Chocolate	2	295	—	6	16	28
600 lb.	Potatoes	96	2238	—	54	—	486
263 lb.	Fresh vegetables	48	357	—	9	—	79
263 lb.	Fresh fruit	48	561	—	7	—	146
	per M. V. per week		23,823	384	323	826	3,235
				707			
				55	46		
Total per Man Value per day			3,400	101		118	462

Vitamins per person per day, values roughly the same as in Model Diet Unit, p. 72. *Extras* not in Budget, tea, coffee, marmite (yeast extract), condiments.

If schools are divided into Houses great economy in catering is effected by a central kitchen and dining-room in which all the Houses are served. The money so saved can be used to provide better quality foods and greater variety. For method and economy in institutional catering housekeepers should follow the excellent example and profit by the experience of Dr. Friend, for over 20 years Medical Officer at Christ's Hospital, Horsham.[1]

A Meatless School Diet

Since 1910 a meatless diet has been consistently followed in the House of Mr. W. A. Sibly, Headmaster of Wycliffe College, Glos., one of the smaller Public Schools. I am indebted to Mr. Sibly for details of the diet.

The food is not strictly plant food. The animal protein amounts to just over 50 g. per boy daily, derived from milk, cheese and eggs. The diet is well-balanced and adequate in Calories and can serve as a model for a meatless diet. An improvement would be to reduce by about one half the amount of sugar and jam, and increase the potatoes to a compensating Calorie value.

The quantities per boy per week are as follows:

	oz.		oz.
Cheese, several kinds	12	Butter	16
Milk, 6 quarts	240	Nut Butter or Margarine	4
Milk Powder	1	Olive Oil, Variable	
Bread 4½ lb.	72	Nuts	In varying amounts.
Flour	5	Dried fruits	
Rice	2	Ready-made vegetarian foods	
Cereals, cake, biscuits	16		
Sugar	12	Fresh fruits	Amounts variable but generous.
Honey and jam	20	Vegetables cooked and raw salads	
Cocoa	3		
Potatoes	40		

Over forty boys are now on this diet. As compared with a larger number of boys in the same school in other Houses on meat diets, the advantage is distinctly with the meatless House in the proportion of boys in the Sixth Form: the general level of health is at least as high and on the average the immunity from influenza has been greater: in all sports which demand sustained effort and endurance the record of these boys has been excellent.

---

[1] *The Schoolboy*, by Dr. G. E. Friend, published by W. Heffer and Sons, Cambridge, 1935.

The meals are arranged as follows :

Breakfast. Just before 8 a.m.

Each Morning. Crisp brown rolls and brown bread *ad lib.* Butter nearly 1 oz. per boy. Sugar, restricted in amount. Honey or marmalade. Fresh fruit or nuts. Milk hot or cold or cocoa made with milk.

Three mornings a week. Egg, boiled, scrambled or omelette.

Four mornings. Large soup-plate of breakfast cereal and nuts slightly browned.

Lunch. 12.50.

Raw (3 or 4 days a week).

Two kinds of cheese, butter *ad lib.*, salads of at least four kinds of raw vegetables, olive oil, fruit, nuts, biscuits.

Brown bread, baked potatoes.

Cooked. Potatoes baked or steamed in their skins. Root and green vegetables conservatively cooked. One savoury dish such as : Cheese pudding. Onions and cheese sauce. Vegetable stew with marmite. Welsh rabbit. Omelettes. Nut and cheese pasties. Nut cutlets or sausages. Vegetable pies with beans, peas, tomatoes, etc. Macaroni with cheese and tomato, etc. Following this a steamed pudding with a lot of raisins and currants ; or orange custard, apple tart, etc.

Tea. 5.50.

Mostly brown bread and a little white. Jam, honey or dried fruits. 1 oz. butter each. " Postum " and milk or plain milk.

One extra such as nut, fruit and chocolate cakes ; or dates ; or nuts and raisins ; or nut and tomato paste, etc. After a cold lunch there is hot soup, or a hot pudding or savoury.

Supper. Just before bed.

Milk in winter. Lemonade or fruit juice in summer. Wholemeal biscuits and fruit.

Sundays. Breakfast late and tea early. Lunch, three or more kinds of fresh fruit and two sorts of dried fruit.

Mr. Sibly advocates a high level of nutrition during the years of growth. The above diet is no cheaper than that of the Houses in which meat is provided.

ECONOMICAL DIETS

VERY simple diets pleasing neither the gourmand nor the gourmet may contain every nutritive essential. In isolated peasant communities depending on local produce the Square Meal is reduced to its simplest form. There is little variety and no temptation to eat just for pleasure.

The highlanders of the west coast of Scotland lived on fish, oatmeal, the eggs of sea birds, milk and curly kale. A favourite dish was a cod's head, one for each person, stuffed with a mixture of the oily fish liver, oatmeal and milk. On this food the inhabitants of Lewis had perfect teeth and infantile mortality was remarkably low in spite of the primitive housing in small hovels of turf and stones, without windows, chimneys and drainage. Similar conditions of housing and food prevailed in the west of Ireland, potatoes replacing the oatmeal of Scotland. In remote Indian valleys encircled by mountains the people live on milk, fruits and vegetables and the products of whole seeds and are free from disease. In the solitary island Tristan da Cunha the food until recently was potatoes, vegetables and fish, the eggs of sea birds, a little milk and very little cereal food. Once a year a ship might call and leave small quantities of sugar and white flour. A ship's surgeon in 1932 found that 83 per cent. of the islanders were free from dental caries. Ships began to call much more frequently and left large amounts of white flour and sugar and a supply of tooth brushes. Toothbrushes could not arrest the rapid increase of dental decay which followed the " civilization " of the diet. Another dental overhaul five years later showed that only 50 per cent. of the islanders then had sound teeth.

To provide Square Meals at a low cost we must revert to a simple type of diet modelled on those just described. A back garden or an allotment will help to lower the cost and improve the quality of the food. Street markets and costermongers sell fruit and vegetables so cheaply that in this respect town dwellers have in the winter the advantage of country folk. The special danger of town life is the continual temptation to buy sweets, ices and shoddy cakes instead of essential foods.

In planning an economical family diet only those foods have been chosen which provide some essential such as vitamins, minerals or good protein as well as fuel. The only exception to this rule is a small allowance of sugar. Bacon is not included, as it contains no essential which is not provided at less cost by the other foodstuffs chosen. Potatoes are employed in a higher than customary proportion and should be boiled in their skins. The health value of the diet depends on the use of natural whole cereals and seed products and health will fail in the long run if white cereals are substituted, or if sugar, jam and meat are increased and replace cereals and potatoes. The budget as it stands is on a generous scale and to economise reduce each item to ¾ of the quantity stated and do not cut out the more expensive items only. Vitaminized margarine can replace butter. Corned beef and canned salmon and condensed milk are cheap forms of good protein. Their vitamin and mineral value is not lost in the canning process and canned salmon is particularly rich in the fat soluble vitamins D and A.

CHEAP DIET FOR FAMILY OF 5.

Father	**1.0**	**Man value. See Table 1.** [p. 132.
Mother	**0.83**	
Child of 3 months	**0.22**	
Child of 10 years	**0.8**	
Child of 6 years	**0.6**	
	3.45	

Foodstuff.	*Cost*	*Calories*	*Protein* *A.*	*Protein* *P.*	*Fat*	*Carbo-hyd-rate*
	s. d.		g.	g.	g.	g.
2½ lb. Corned Beef	1 6	3900	384	—	246	—
2 lb. Cheese	1 0	3878	226	—	300	28
1 lb. Herring	0 7	662	69	—	41	—
1 lb. Tinned Salmon	1 1	915	100	—	54	—
1 lb. Condensed Milk	0 5	976	37	—	54	65
1 lb. Mince	0 8	1505	74	—	45	—
8 qt. Milk	4 0	6048	288	—	320	432
8 Eggs at average price for year	1 0	659	50	—	46	5
1 lb. Flour, wholemeal	0 2	1639	—	53	9	326
14 lb. Bread, wholemeal	2 11	14196	—	448	14	3010
3½ lb. Middlings	0 4	5782	—	196	16	1176
1 lb. Rolled Oats	0 2¼	1809	—	59	29	315
½ lb. Lentils	0 1¼	789	—	45	1	145
½ lb. Beans, dried	0 1¼	761	—	42	1	141
1 lb. Yellow Maize Meal	0 3½	1712	—	45	9	351
½ lb. Barley, natural brown	0 2	825	—	16	2	181
½ lb. Rice, natural brown	0 2½	820	—	15	1	184
1 lb. stoned Dates	0 4	1131	—	6	—	268
1 lb. dried Figs	0 5	1109	—	9	2	256
1 lb. Jam	0 4½	1296	—	1	—	315
2 lb. Sugar	0 4½	3680	—	—	—	898
28 lb. Potatoes	2 0	10444	—	252	—	2296
Vegetables, root and leaf, etc. Oranges, tomatoes, bananas, Apples	3 0	2800	—	65	—	600
1 lb. Empire Butter	0 9	3504	—	—	376	—
2 lb. Margarine, vitaminized	0 8	7158	—	—	772	—
1 lb. Dripping, suet	0 8	4218	—	—	454	—
Per Man Value of 3.45 per week	23 3¾	82,215	1,228	1,252	2,792	10,992
Per Man Value per week cost at London shop prices (1934–35)[1]	6 9		2,480			
Per Man Value per day	0 11½	3,404	50	51.8	115	455
			102			
Approx. Vitamin Values per per head day :						
A 4,000 int. units						
D 270 ,, ,,						
B_1 930 ,, ,,						
C 57 mg. ascorbic acid						

---

[1] Would cost less at "cash and carry" shops and street stalls.
Cost at British Medical Association, Mean Price, 5s. 7d.
1939 (before September) price about 8s. 6d. per week.

In sharing the food it must be remembered that the infant's allowance belongs to Mother if she is nursing the child. Of the eight eggs, allow 1 for Father, 2 for Mother and 2½ each for the older children.

Suggestions for apportioning the food into meals:

Breakfasts:

Consist mainly of porridge made with middlings and a little rolled oats, milk or bread and milk. Bread and butter or margarine. Jam. Scraps of dinners and suppers left over. Alternatively if preferred breakfast may be made more substantial than supper.

Dinners:

(1) Minced beef.[1] Cabbage, mashed potatoes. Creamed[2] rice. Fresh or stewed fruit.

(2) Home-made potted corned beef. Watercress. Baked potatoes. Baked apples and left over creamed rice.

(3) Salmon fish cakes (⅓ fish to ⅔ potato). Greens. Potatoes boiled in skins. Junket and stewed figs.

(4) Corned beef and potato pie. Cabbage. Apple Charlotte.

(5) Cauliflower cheese, baked potatoes and margarine. Steam pudding and fruit or jam.

(6) Herrings. Mashed potatoes. Bread and butter. Sliced oranges and banana.

(7) Maize and onion rissoles, potatoes. Grated cheese. Date pudding.

Suppers:

Bread and margarine, or dripping toast, or biscuits and butter, milk. Fruit, and one substantial dish such as: Cheese, plain or toasted. Maize fritters and cheese sauce. Barley and vegetable stew. Butter beans with carrots. Scrambled eggs and mashed potato. Savoury rice with onions, cheese, parsley, potato, etc. Lentil and vegetable pie.

Biscuits are home-made from middlings and flour or oatmeal. Suet crust and dumplings can be made partly with middlings.

[1] Minced beef is chosen for convenience in calculating food values as there is no waste. Cheap cuts of meat are more practicable, providing fat for dripping, bone for soup and better value for money.

[2] Made with full cream condensed milk.

EXPLANATION OF FRONTISPIECE AND COLOURED CHARTS

IN the *frontispiece* A SQUARE MEAL is the symbol for a complete diet. The central white circle represents the bulk of the food, the protein, fat, carbohydrate and mineral salts. These materials cannot maintain life without the addition of the various vitamins represented by the four coloured corners. Distinctively coloured enlargements of these corners give lists of the most important vitamin-containing foodstuffs which contribute to a Square Meal. A complete diet consists of suitable mixtures of foodstuffs from all four coloured sections.

The colours are chosen as an aid to memory: *yellow* for fat-soluble vitamins recalls the colour of butter, egg yolk and carrots: *brown* for vitamin B_1 suggests wholemeal bread, yeast extract, lentils and seeds generally: *red* for vitamin B_2 complex on account of its association with animal flesh; *green* for vitamin C as suggestive of succulent plant tissues, especially green vegetables.

The same system of colouring has been used in the squared vitamin index attached to each food in the analytical charts. These merely indicate presence or absence. Fuller information as to quantity is given in Tables 9 to 14. Some common foodstuffs have not so far had all their vitamin values estimated. The vitamin content varies greatly in different samples. Soil and sunshine affect the vitamin value of plant tissues and the products of the animals who use these plants for food.

The Coloured Charts at the end of the book show at a glance the percentage composition of common foodstuffs together with their fuel value (Calories) and vitamin content.

Different samples of the same kind of foodstuff may vary considerably. The charts represent the average composition. In the case of meat from animals which may or may not have been fattened for market the proportions of protein and fat are very fluctuating.

The colour device is *red* for protein, *yellow* for fat, *brown* for carbohydrate, dotted *black and white* for mineral salts, *blue* for water and *black* for unabsorbed residues such as bone or fibre.

The colours red, brown and yellow have no direct connection with vitamin content except in the attached *vitamin index*. The proportion of mineral salts in some instances, as in cheese, bacon, etc., includes sodium chloride added to the natural salt supply.

On turning over the charts and looking first at the red areas it is seen that the foods with the highest protein content are the hard cheeses in Chart 10. Some plant products have as much protein as meat, or more, but on account of poverty in certain amino acids, plant protein is termed *2nd class*.

Plain yellow strips on Chart 12 indicate pure 100 per cent. fats.

On Chart 16 an all brown strip represents pure carbohydrate in the form of white sugar. On Chart 15 are other carbohydrate foods of pure starch + a little water ; sago, tapioca, etc.

Perhaps the most striking point to those unfamiliar with food analyses is the large amount of water contained in apparently solid foods. For instance in lobster, three-quarters of the flesh is water. At the price of 2s. 6d. to 2s. 9d. a lb. by the time wastage for shell, etc., has been allowed for, the water in the edible part costs roughly 4s. a lb. Dry foods, such as cheese, offer good value for money.

Not one of the foods is in itself a complete diet for adults. If such a food existed it would show roughly 1 red : 1 yellow : 4 or 5 parts brown ; mineral salts and a full vitamin index. This composition has to be attained by a judicious mixing of the four main classes of foodstuffs, as in this diagram

FAT OR BUTTER CLASS	SEED OR BREAD CLASS
FRESH FRUITS AND VEGETABLES	MEAT OR OTHER 1ST CLASS PROTEIN

which is just another version of the SQUARE MEAL (see frontispiece). Natural foodstuffs such as egg yolk, milk, liver, tomatoes, wheat germ, green vegetables are composite mixtures belonging to more than one of these sections.

On scrutinizing the colour charts it can be seen what each foodstuff provides and which are the other foods to make good its deficiencies. Three examples of quite simple Square Meals are:

Milk and Potatoes,
or Eggs, Cheese and Potatoes,
or Milk, Oatmeal and Scotch Kale.

The aim for the normal person is a well-proportioned diet containing foodstuffs that contribute to each of the four sections, and the Square Meal can be modified to suit the needs of the individual.

Square Meals for Infants

For the breast-fed infant milk is a complete diet if the mother has proper food. Commercial cows' milk should be supplemented with vitamins A, D, B_1 and C and some form of iron.

If the mother's food lacks any essential the mother and child cannot thrive. During pregnancy and lactation a great increase in the fuel value of the diet is not necessary but the maintenance of a good supply of vitamins, proteins and mineral salts is of the utmost importance. Clinical tests for ascorbic acid have shown that many infants given orange juice do not receive enough. Vitamin B_1 is most easily given in the form of yeast extract, and vitamins A and D as halibut liver oil.

The subject of the artificial feeding of infants is too large to be considered in a small space. In weaning the chief difficulty is to avoid too sudden a reduction of the ratio of animal protein as provided in milk. The solution of this problem without overloading with cereals and with care of the vitamin supply is dealt with practically by Dr. Harold Waller in a most helpful pamphlet.[1] Foods rich in minerals are important for normal growth; consult Table 8 (p. 143).

---

[1] *Recipes for Food and Conduct*, pubd. The Babies Club, 35 Danvers Street, Chelsea, London. Price 2s. 6d.

Square Meals for Children in Elementary Schools

In 1937 only 8 per cent. of the children received the free meals or milk which the Education Act of 1921 empowered the local authority to provide, the Exchequer to contribute 50 per cent. of the cost.

Cod liver oil or milk are the supplements most commonly given; milk most frequently of all because it is easy to serve and it provides an outlet for the large surplus of milk which the Milk Marketing Boards have left on their hands because of the fantastically high retail price they charge. Also milk is generally accredited with being a wonderful food for children. The slight improvement that the small milk supplements make in the children's physical condition is mainly due to the good quality of its protein and the provision of calcium and phosphorus for bone formation. Since it has been discovered that the majority of the children are anæmic the futility of providing nothing but milk which lacks iron is obvious.

Few schools have facilities for serving hot midday dinners and in any case the usual type of school dinner repeats the faults of the home food.

School meals should be so designed as to make good the shortcomings of the ordinary working-class diet. There is seldom insufficient energy value as white bread, margarine and sugary tea provide cheap Calories. The supplements needed are protein of good quality, vitamins, and a suitable mineral mixture. The best method of doing this is to provide a breakfast[1] about ten o'clock of milk[2] (½ to 1 pt.) whole-meal bread roll or sandwich spread with butter and yeast or yeast extract, and with alternative fillings of meat, egg or cheese and an orange, or tomato or cress.

These breakfasts have produced excellent results in schools in Glossop and in Birmingham and are modelled on the *Oslo Breakfast*. This breakfast was devised for Norwegian children to make good the deficiencies in the home diet, in particular to protect against scurvy. The Oslo breakfast consists of a roll of wholemeal rye bread and a generous pat of butter, a chunk of cheese, an orange, fresh fruit or salad according to prices. The health and growth of the children was much better than if provided with a hot meat and vegetable lunch. The same plan has since been widely copied all over Scandinavia.

---

[1] As advised by Dr. Milligan, M.O.H. for Glossop.

[2] Milk not a safe food for children unless *pasteurized*. All milk for school use should be pasteurized.

Square Meals for Animals

Loss through disease in animals costs the farming industry £19 million annually. Resistance to disease depends on good management as regards shelter and free exercise but mainly on the kind of food. So called *scientific feeding* of live stock is often not really scientific but simply artificial. Feeding cakes and manufactured foods replace good grass, silage, peas and beans and other home-grown feeding stuffs.

A return to a more natural system of feeding is advisable, using the Square Meal as a guide towards the construction of a balanced diet. Cows, poultry and dogs do not require to have vitamin C provided in their food. Cattle and birds need plenty of good grass and other greenstuff, not for vitamin C but for the vitamin A and minerals which it contains, and also because the proteins of leaves are supplementary to seed proteins.

Pigs are sensitive to lack of vitamin C and show it by loss of curl in their tails. Pigs are often given overcooked food and are much healthier when allowed to run on the land and forage for themselves. Pigs in styes deprived of sunshine and improperly fed are very subject to tuberculosis and rickets, and for the prevention of these diseases it has become customary to give cod liver oil to pigs. One teaspoonful a day of a good quality oil for the first 14 weeks should be sufficient. If the oil is given too long and in too large quantities the fat of the animal becomes oily and tainted. For Vitamin B_1 animals usually fare better than human beings as they get *the offals*, the most nourishing part of the grain.

Lard, bacon and pork fat are poor in vitamins A and D but the fat from pigs allowed open range is richer in these vitamins than that of stye pigs. Chickens with bent breast bones have suffered from rickets and their fat is likely to be poor in both vitamins D and A.

Protein of good quality is important for strong growth, for breeding, milk production and egg laying. Fish meal provides good protein but may taint the food products. It is well to remember the supplementary action of leaf and seed proteins for providing a balanced diet.

The tendency has been to breed for spectacular yields of milk and eggs regardless of the effect it has on the animal itself, on its offspring, and on the nutritive value of the products for human consumption. A 3,000 gallon cow produces about 3⅓ tons of milk and a 300 egg hen nearly ⅓ a cwt. of eggs. The effect very often is that the cow becomes barren, and that " the tired eggs " produced by the overworked hen have on hatching an abnormally high mortality rate among the young chicks.

Egg yolks from high productive pullets averaging 236 eggs a year have in the fourth month of their first year an average value of 560 int. units of vitamin A per ounce. From pullets averaging only 93 eggs a year, the yolks at the same period contain 920 units per ounce.[1]

At the beginning of a laying period the yolks contain five times as much vitamin A as at the end.

These figures for vitamin A values explain the phenomenon of " the tired egg " which puzzles poultry farmers.

The deterioration in the value of the egg both as food and for breeding purposes could be corrected if the vitamin value of the poultry food was raised as the egg-laying period advances and the store of vitamin A in the liver is depleted.

The depth of colour of egg yolk or butter is not a guide to the vitamin A content as other pigments besides carotene colour the yolk. If the hens derive vitamin A from cod liver oil instead of from green leaves the yolks are pale but the vitamin value good.

The value of milk, cream and butter as human food also depends on the feeding of the animal. Butter from cows at pasture may contain 1,260 international units per ounce of vitamin A and the value of butter falls almost to nothing in winter if the food is poor. There are similar variations in the vitamin D value of milk and butter.

As in the case of eggs the value of dairy products from cows producing enormous quantities of milk is likely to be low in vitamin A especially towards the end of the lactating period.

---

[1] *Vitamin Content of Foods.* United States Dept. Agriculture Miscellaneous Publication, No. 275.

Abortion in cattle has been successfully treated by increasing the intake of vitamin E.

The health of animals is improved, and also the nutritive value of their products for human consumption, if they are reared on grassland kept fertile by methods described in the final chapter.

Square Meals for Slimming

Judicious slimming by those who are over-weight is no mere pandering to a fashionable craze but a method of preventing the development of degenerative organic disease in middle life (p. 42). Obesity is a sign of malnutrition.

In dieting for obesity many people avoid fatty and starchy foods and by so doing cut the top off the Square Meal. This unbalanced diet is deficient in vitamins and favourable to the development of colds, influenza and tuberculosis. Square Meals and slimming are not incompatible and Square Meals are essential to weight-reducing without disaster. As long as the daily intake of fuel food is slightly less than the energy output, the body weight must inevitably come down. The balance of intake and output should be adjusted so as not to lose weight more rapidly than 1 to 2 lb. a week. The result is no less sure because it is achieved slowly, and it is dangerous to remove hurriedly the accretions of half a lifetime.

To plan Square Meals of satisfying bulk without too many Calories, look at the charts and choose those foods which consist largely of water (*blue*) and fibre (*black*) and build the diet with these. Eggs, milk, potatoes, fruits, green salads, fish, oysters or the cheaper scallop, kidney, liver, brain, sweetbread, lean veal and lamb offer a variety of choice. Bread and porridge are more watery and therefore weight for weight less fattening than dry toast or biscuits: fat cannot be formed from water. Obesity is sometimes due to retention of water in the tissues, a condition common in vitamin B_1 deficiency, and relieved by the inclusion of this vitamin in the diet in the form of wholemeal cereals, with added bran, germ and yeast extract.

Butter can be taken with moderation but sugar and alcohol should be banned from any reducing diet as these substances are of high fuel value and contribute no essential. 1 g. of alcohol supplies 7 Calories and has a fuel value nearly equal to that of fat. The addition of alcoholic drinks to a diet already sufficient in energy value is a common cause of obesity.

Diet in Pathological Cases

In the treatment of disease unbalanced diets have sometimes to be prescribed. Thus for a diabetic, foodstuffs showing much *brown* in the charts have to be restricted, the proportion of carbohydrate being calculated for each case according to medical prescription. High fat diets, that is of the *yellowest* foods, have occasionally to be devised. In other cases fat has to be curtailed. These one-sided diets are for special cases and emergency use.

Digestion of Square Meals

The American fashion which invaded this country of splitting the day's food into protein meals and carbohydrate meals has no physiological basis. These special diets are health producing not because they separate protein and starch but because they correct common faults by reducing the amount of meat, white cereals and sugar, and by increasing the amount of fruit, salad, vegetables and wholemeal cereals.

The healthy digestive tract is designed to deal with Square Meals. Proteins and carbohydrates occur together in so many foods that their separation is as difficult as it is unnatural and unnecessary. Alkaline saliva begins the digestion of starch. In the stomach muscular contractions of the walls help to pulp the food : acid gastric juice begins protein digestion, prevents fermentation of carbohydrate and growth of harmful bacteria. After these preliminaries, it is in the alkaline juice of the intestine that the mixture of protein, fat and carbohydrate is completely digested and absorbed.

NOTES ON FOODSTUFFS

THE composition of **Meat and Meat Products** is represented in Charts 1 to 5. The illustrated analysis of Rump Steak includes a high proportion of fat as purchased. Some fat may be wasted and some rendered as dripping. An analysis of *the lean* only, of steak or any other cut of beef, has an *average* composition of :

Protein	21 per cent.
Fat	8
Mineral Salts	1
Water	70
	100

The flesh of old animals fattened for market has relatively more fat and less protein than in lamb and veal.

Cold storage and canning do not appreciably spoil the quality of the protein or diminish the vitamin value of meat. Imported meat from good grazing countries may be superior to home produce fattened on oil cakes and roots.

Meat although so popular is by no means an economical or indispensable article of food. It contributes to the diet good quality protein, vitamin B_2 complex, a little vitamin A, and some mineral salts, all of which can be more cheaply provided by other foods. Corned (canned) beef is the kind of meat which offers best value for money. Ham and bacon contain relatively little protein and are expensive forms of vitamin-poor fat. The lean of pork, ham and bacon contains vitamin B_1.

Meat extracts are stimulants and not foods unless they contain pulverized muscle.

The internal organs, especially the liver, and also the heart, kidney and sweetbread are richer in vitamins than the flesh.

Poultry and Game (Chart 5) are flesh foods alternative to meat and of no better food value to compensate for the higher price. The flesh contains less fat than does meat and is therefore more quickly digested and prescribed for invalids.

Fish and Shell Fish. Charts 6, 7 and 8 show that fish contains about as much first-class protein as meat. In different kinds of fish the fat content and therefore the fuel value vary greatly. Fish livers are extraordinarily rich in vitamins A and D and hard roe contains vitamin B_1. The flesh of white fish is poor in vitamins except for B_6 and B_7.

The body oils of salmon, herrings, sardines and the eel are rich in vitamins A and D. It is likely that mackerel, pilchards and other fish with oily flesh have similar high values.

Canned salmon is a valuable food providing at a low cost first-class protein, fat, mineral salts and vitamins A, D and B_1. Sardines, whitebait and tinned brisling, eaten bones and all, contain calcium phosphate which will be partly extracted by the acid gastric juice.

Oysters and scallops and other shell fish, of which the internal organs as well as the flesh are eaten, are relatively rich in vitamins, A, D, B_1 and B_2, and oysters are said to contain vitamin C. All sea-foodstuffs supply iodine.

Milk and Milk Products (Chart 9). Milk is a combined food and drink. Globules of finely divided fat are suspended in a watery solution of protein, milk-sugar and mineral salts. The composition is variable : protein 3 to 3½ per cent., fat 3½ to 4½ per cent., carbohydrate 4 to 5 per cent. The chart represents the minimum standard value for commercial milk. The carbohydrate in milk is lactose, a sugar which does not taste sweet and which has the advantage that it does not ferment in the digestive tract. Milk for bottle-fed infants requires to be supplemented with vitamins (pp. 59, 63, 66) and iron. Raw milk may carry the germs of many infectious diseases, and if not pasteurized at the dairy should be scalded at home.

In most milk producing countries more sour milk and curd are consumed than in England. The souring of milk is beneficial, the lactic acid formed prevents to a certain extent the multiplication of harmful bacteria and introduces into the digestive tract bacteria which inhibit the putrefaction of protein. The longevity of those races in which sour milk forms a large part of the adult diet is said to be remarkable. In sour milk the calcium salts are more easily assimilated.

Dried Milk is prepared by various processes which are no more destructive of vitamins than the treatment which fresh milk unavoidably receives during distribution to towns. Some manufacturers add vitamins A and D in proportions suitable for infant feeding.

Condensed Milk, full cream, is a cheap and valuable form of first-class protein, milk sugar, fat, mineral salts and vitamins A and D. Sweetened condensed milk is not to be recommended on account of its high sugar content. Condensed skim milk is a good meat substitute for adults.

Clotted or Devonshire Cream contains some curd (protein) and is less likely than separated cream to cause biliousness.

Cheese. Charts 10 and 11 show the variability in composition of cheese from the hard Blue Vinney of Dorset to the super-fatted Stilton. For the provision of first-class protein at a low cost imported cheese has no rival except canned corned beef; of the two cheese is preferable for its richness in mineral salts. Cheese and potatoes; *or* cheese, wholemeal bread and watercress make simple Square Meals.

Eggs (Chart 11) contain protein of high biological value, emulsified fat in an easily digestible form, and mineral salts including iron and phosphorus. Designed as a complete food for the developing chick which does not require vitamin C, eggs lack this vitamin. The yolk is rich in iron, vitamins A, D, B_1 and B_2. Vitamin C and carbohydrate must be added to eggs to make a complete diet. Potatoes and eggs together make a Square Meal.

Cereals and Seed Products (Charts 13 and 14). Cereals are the staple food. The tendency is to replace more and more cereal by meat, sugar and fat. The refined white cereals which were introduced with machine milling are impoverished foodstuffs, although chemical analysis shows little difference. Whole cereals approach very nearly to a complete diet and require only such supplements as green leaves and milk. The proteins of the bran and germ are of better quality than those of the white core or endosperm. The germ of cereals contains vitamin E. Three-quarters of the mineral salts, practically the whole of the vitamin content and the best quality proteins are removed in the process of roller-milling to make white flour. On account of their dark colour the outer layers of the wheat endosperm are also discarded as human food and sold as poultry food. In composition *middlings* closely resembles white flour but has a high value for vitamin B_1. Middlings make a pleasant porridge either alone or mixed with oatmeal, and admixed with oatmeal or flour can be made into cakes or biscuits.

The grains of rice and barley are similarly denuded in the milling of white rice and pearl barley. Both polished and unpolished rice are white rices; a hand lens shows that in both kinds the germ and bran are lost. The polishing is an extra shining up of the white endosperm between buffers. Natural brown rice and barley and wholemeal macaroni are obtainable at Health Food Stores. From oats and rye the bran and germ are not easily separated and these grains suffer less loss in milling. Yellow maize meal contains some vitamin A. Dry seeds contain no vitamin C but it is formed as the seed sprouts. Germinated seeds, such as peas and beans, are useful for the provision of vitamin C where fresh vegetables are not available.

Malt is a preparation of sprouted barley dried and powdered. Its sweetness is due to sugar formed by the action of an enzyme *diastase* on starch. Commercial malt and beer contain no vitamin C but by means of fresh malt and home-brewed beer Captain Cook was able to eliminate scurvy on his long voyages.

Malt extract contains no vitamin C but has a valuable amount of vitamin B_1 and contains the starch-digesting enzyme in varying degrees of activity. The combination of vitamin B_1 and carbohydrate in a soluble form makes malt extract very suitable for admixture with cod liver oil to help in the assimilation of the oil by rickety children.

Pulses (Chart 17) are the dry seeds of leguminous plants such as peas, beans and lentils. Pulses contain more protein than cereals but of inferior quality, requiring the addition of leaf and cereal proteins to make them more equivalent to animal protein. Peanuts are legumes popularly classed as nuts on account of their shells and richness in fat, but like all legumes peanuts require prolonged cooking to make them digestible.

In pulses the vitamins of the B complex are evenly distributed through the endosperm and not confined, as in cereals, to the bran, germ and outer layers. Soya beans contain vitamin A.

Nuts (Chart 18) are the standby of vegetarians and their best meat substitute. Nuts contain mineral salts, vitamin B_1, protein, fat and carbohydrate. They are a concentrated food and do not, like the cereals and pulses, have to be admixed with water. The protein of a blend of almond and walnut is reported to be satisfactory for the nutrition of man without additional animal protein. Nuts slightly browned and grated are easier to digest than raw nuts. Coconut has little food value as compared with other nuts ; it is poor in vitamin B_1, protein and mineral salts. Chestnuts differ from the typical nut in containing little protein or fat but a large amount of carbohydrate, and have some vitamin C. Brazil nuts contain 70 per cent. of fat. Cashew nuts contain some vitamin A, but nuts generally though so rich in fat are poor in fat-soluble vitamins.

Chocolate and Cocoa (Chart 12) are prepared seed products without vitamins but of a high fuel value because of the fat which they naturally contain and the sugar which has been added. Cocoa contains more protein and mineral salts than chocolate. As unbalanced foods of high energy value cocoa and chocolate should serve only as flavouring agents and not as substantial fuel foods.[1]

Fats and Oils (Chart 12). 100 per cent. fats are the most concentrated of all fuel foods. Variations in the vitamin value of fats must be noticed, see Tables 9 and 12. Bone marrow is an excellent fatty food for children. Margarine consists of a mixture of oils and fats other than butter fat and its value for vitamins A and D varies from 0 to higher than in butter according to the ingredients and method of manufacture. About 80 per cent. of the margarine now on the market is vitaminized, that is has added concentrates of vitamins A and D to make it equal to good butter. Pork and bacon fat cannot be relied on to provide fat-soluble vitamins. Vegetable oils of a naturally deep yellow-red colour may contain A but not D.

Sugar, Syrup, Jam, Honey (Chart 16). The disadvantages of sugar as an unbalanced fuel food have been mentioned on p. 27. In extenuation of over-indulgence it is said that children have a *natural* craving for sugar and that therefore it must be good for them. Since concentrated sugar is the least natural and the most artificial of foods this claim is nonsense. A craving for sugar is an acquired habit like that for alcohol or tobacco. Nature carefully avoids offering sweetness as a stimulant to appetite: milk sugar does not taste sweet and in fruits the sweet is masked by acids. The present cheapness of sugar is a temptation to excess; formerly the consumption of sugar was restricted by its high price and scarcity. Children now suck sweets at all hours and reject wholesome foods as insipid. Disguised as chocolates and ice cream, sugar is perambulated in all places of amusement and along the highways. Sugar having ousted cereals from their proper place in the diet, the surplus of unwanted cereal is now converted into *corn syrup* and the sugar *glucose.* To create markets for these new products sugar is boomed in newspaper articles saying "*1 lb. of sugar contains as much nourishment as 2 lb. of beefsteak, or 22 eggs or 5 pints of milk for a fraction of the price.*" If by nourishment we mean fuel value only these claims are fair, but if by nourishment is implied some contribution of essential material, such as protein, vitamins or mineral salts, then the claim is unfounded. It is this very high fuel value unaccompanied by any essential food material that upsets the balance of any diet in which sugar serves as an important fuel food and not merely for flavouring.

---

[1] Commercial cacao shell, a powder made from the fermented, sun dried beans, has a very high vitamin D value due to growth of yeasts. It is a useful winter food for cattle and poultry to improve the vitamin D value of milk and eggs.

The bad effect of sugar upon the teeth is due not so much to direct local action in favouring bacterial infection as to its indirect action. In replacing milk, fruit and greenstuff, sugar deprives the body of the materials required for the construction of sound teeth able to resist bacterial invasion.

In England during the War, the supply of sugar was limited and the mortality from diabetes decreased. The effect of prohibition in the United States was to increase the consumption of sugar and there was a corresponding rise in the death rate from diabetes. In the U.S.A. about one-fourth of the total fuel value of the diet is derived from sugar. It is impossible that the rest of the diet however skilfully composed can make good the poverty of sugar in everything but cheap Calories.

Chemically there are several varieties of sugar. Cane sugar or *sucrose*, milk sugar or *lactose*, malt sugar or *maltose*, are double sugars split during digestion into the simple sugars, *glucose*, *fructose*, etc. Starch during digestion is converted into glucose. The body can therefore get all the sugar it requires from the starch of whole cereals and other seeds, from potatoes and fruits, accompanied by other valuable constituents and without the irritation of the digestive tract caused by concentrated sugar. Sugar should replace starch only for emergency use. Under the following special circumstances the use of sugar as a fuel food is justified on account of its rapid absorption.

(1) For athletes while engaged on feats of endurance.

(2) In cases of coma, or collapse due to *auto-intoxication*, or *acidosis ;* or in diabetics to counteract insulin.

(3) In cases of heart failure from inanition.

(4) Last thing at night and first thing on waking in cases of " morning sickness " during pregnancy.

(5) To prevent sea-sickness, or travel sickness, or nausea after an anæsthetic.

Treacle or genuine **Molasses** is the non-crystallizable residue left over in the manufacture of sugar. It contains a high percentage of sugar, a varying proportion of water, and valuable mineral salts and other materials from the sugar cane. Syrups prepared from cane sugar or glucose contain little mineral salts.

Jams, Marmalade, etc., have a high percentage of sugar, more in commercial than in home-made jam, and should be served sparingly.

Honey was at one time the chief sweetening agent available in Europe and its scarcity made over-consumption unlikely. Honey is so delicious it is sad that its claim to contain vitamins cannot be substantiated.

Fresh Fruits (Charts 19 and 20) consist mainly of water and make little contribution to the fuel value of the diet. The special value is richness in vitamin C. Apricots, fresh or dried, oranges and tomatoes prunes, bananas, canteloupes and dates contain some vitamin A. Vitamin B_1 is present in small amount in oranges and tomatoes, and tomatoes also supply a little B_2. The mineral content of fruits is important. The iron in raspberries is said to be good for hæmoglobin formation.

Dried Fruits (Chart 21) have lost vitamin C but are relatively cheap fuel foods supplying sugar admixed with protein, vitamin A, mineral salts and fibre.

Vegetables (Charts 22 to 25). Green leaves are the plant tissues in which there is intense chemical constructional activity. Leaves are very rich in vitamin C and contain some B_2, and traces of B_1. For vitamins A and C and for calcium salts the outer dark green leaves are greatly superior.

Roots, tubers, bulbs, fleshy stems and seeds have stores of reserve material in the form of carbohydrates and oils and contain less water than the leaves. Carrots are particularly valuable for vitamin A and swedes for C. Vegetables are relatively poor in vitamin B_1 (see Table 10, p. 146).

For all-round merit and cheapness few foodstuffs can surpass potatoes and they should be more extensively used. Potatoes can be served in so many ways that no one tires of them. Containing as they do protein of fairly good quality, carbohydrate, mineral salts and vitamins C, B_1, B_2, A, their contribution to the Square Meal is a very large one. With milk they form a complete diet. Sieved floury potato is a good form in which to introduce starch into the diet of the infant.

Vegetables and fruits contain traces of ergosterol which on activation by sunlight is converted into vitamin D.

Yeast (not included in the charts) is a minute unicellular plant which multiplies at an amazing rate and has great chemical activity. Yeast is used in bread-making and in brewing. Yeast is a veritable factory of vitamins B_1 and B_2 and contains ergosterol. The amount of yeast which can be used in bread-making is not enough to improve the negligible vitamin B_1 value of white bread. Fresh brewers' yeast and dried yeast are old-fashioned and efficaceous remedies for boils. Concentrated extracts of yeast were first utilized by vegetarians as substitutes for meat extracts in gravies and stews. Yeast extracts (Marmite, Vegex, etc.) are rich in vitamins B_1 and B_2 but do not contain ergosterol.

Salads and Herbs

When food was valued mainly for the energy that it gave or the protein that it contained, salads were regarded as pleasant luxuries, one of the first things to be cut out in economical planning. Now that salads are revalued for their vitamin and mineral contributions one of the main problems in preventing malnutrition is to popularize salads in inexpensive and attractive forms. We have much to learn from the Americans who have perfected the art of salad making and combine leaf, root and fruit with cheese, fish, egg, flesh or nuts most attractively. A mixed salad of this kind becomes a complete Square Meal if eaten with buttered bread or biscuits.

Salads are delightfully cool and refreshing in a hot dry climate or in American steam heated buildings but one has only sympathy for the British father, who on a chilly damp day likes to be welcomed home by the inviting smell of onions frying or of meat roasting. He despises the salad of the tiresome food reformer as cold, clammy and unsatisfying. Yet it is in the cold weather that salads of raw vegetables are the most needed, for in summer there is a choice of fresh fruits and the supply of vitamins A and C is better in summer foods. Efforts should be made to cultivate the salad habit. Table 14 gives the commonest ingredients of mixed salads and shows the vitamins and minerals which they contribute.

Lettuce, which forms the basis of most salads is disappointingly low in both vitamins A and C. Compact yellow lettuces grown for town markets have not the value of the loose greener garden lettuce. The same applies to celery, cabbages and other greens. Chopped raw cabbage or young celery leaves can be used instead of lettuce. Mustard and cress can be grown at home by town children all the year round, on damp cloths, or in boxes on window sills. In winter when green stuff is so scarce, imported tomatoes are at their cheapest and watercress is seldom out of season. Rooted sprigs of watercress from a bought bunch will grow and increase in a water tub in a backyard. Dried green peas, soaked and sprouted can after boiling be added to a salad.

In the spring, thin green dandelion leaves gathered while very young and tender are not bitter and by themselves make a most delicious salad. In France the peasants harvest the wild dandelion leaves in sacks and market them in the towns. In the Crimean war the British suffered severely from scurvy but the French troops ate wild green stuff and kept free from scurvy. Many other kinds of green leaves and raw vegetables can be used and one enthusiast in a B.B.C. talk has extolled the virtues of grass for human food. Leaves and vegetables which are tough or earthy can be used after washing and then scalding for five minutes in boiling water. Raw carrots, celeriac, horseradish are more digestible if finely shredded or grated.

A revival of the lore and practice of the herbalist is urgently called for so that the free gifts in the hedgerows and fields are not wasted. If war should cut off or reduce our supplies of imported fruits, a knowledge of which are the wholesome and which are the harmful wild plants would be of great value. In this salvage of natural foodstuffs organizations such as the Women's Institutes, Boy Scouts and Girl Guides, directed by botanists and herbalists could combine for the common welfare.

Culpeper who published his famous herbal in 1653 observed that "*in all herbs the wild are the most effectual . . . being more powerful in operation than the garden kind.*" This is a fact which has already been commented on in connection with the vitamin values of wild and cultivated leaves and berries (pp. 57, 65).

In the days before imported fruits and vegetables were so cheap in winter, inhabitants of cold regions suffered badly from lack of vitamins A and C. The old herbals contain many remedies *against the stone*, for skin ailments, *sore eyes* and dimness of vision, symptoms indicating shortage of vitamin A. The prescribed remedies, generally green leaves such as young nettles or parsley, provided the missing vitamin abundantly. Hawthorn berries (so rich in vitamin A) were *beaten to a powder and drunk in wine as singularly good against the stone.* Other herbs including sorrel and horseradish were recommended as *cleansing the blood* and *very effectual against the scurvy*; and rose hips as *preserving the gums and teeth against corruption*, which is also a sign of scurvy.

An infusion made from hips and haws is used at a modern Swiss clinic run on nature cure lines. The leaves of the cuckoo flower so common in the spring are *excellently good for the scurvy, very little inferior to the watercresses*, and these leaves also *break the stone.*

Even the common dock leaf had its uses. Culpeper said that dock leaves boiled with meat were good for cleansing the blood but not popular because they made the potage black. Potage and broth included a variety of herbs and vegetables. Our traditional English sauces made with mint, capers, fennel, tarragon, chervil, horseradish or parsley are handed down from the old days of threatening stone and scurvy.

Cooking and Canning of Foods

> "The British housewife compares very unfavourably with the French or German wife in her skilled care in preparing and cooking food. I can conceive of no single reform that would so increase the health and happiness of half the nation as the acquisition by the women of England of domestic virtues of this kind."

Sir Arthur Salter, M.P., speaking thus (at the Conference on Nutrition organized by the British Medical Association in London, 1939), is one of many who blame the British housewife for her lack of interest and skill in the choice and preparation of food.

It is true that the average level of culinary skill in Great Britain is deplorably low. In artistry and savouriness English cooking cannot compare with that of other European countries, yet as far as any real knowledge of food values goes the ignorance of the British housewife is no worse than that of her Continental neighbours and by a lucky chance her actual practice happens to be better for preserving the vitamin value of foods.

Housewives in Germany, Holland and Scandinavia are wise in their use of rye bread and in this country we can buy wholemeal wheaten bread if we will, but in France only the whitest of white bread is ordinarily obtainable. Although the birthplace of Pasteur the first bacteriologist and father of modern aseptic methods, France lags behind other countries in the hygienic handling of bread, milk and other foods. In France it causes neither surprise nor revulsion if a woman sits at her front door picking over spinach which is resting on the manure heap that bridges the gap between house and high road.

The English cook plain boils her vegetables; only cold left-over vegetables are sometimes reheated.

But study a collection of continental recipes![1] Vegetables as a rule suffer two or three processes that reduce vitamins A and C to vanishing point. Remember that classic tale of a scurvy outbreak in a Viennese sanatorium[1] because the good supply of fresh vegetables had been cooked to death. *Sautés* potatoes, whether the French *à la Lyonnaise* or Italian *alla Veneziane*, are first boiled and then heated again in fat. And those delectable *purées* of spinach, sorrel, chestnuts or potatoes, are first boiled, then well beaten and finally reheated : that is *three* processes destructive of vitamins. Lettuces or endives *braisées*, or red cabbage are simmered gently for hours. Marrow, cauliflower or broccoli cooked *au gratin* are first heated slowly in water and then baked in the oven. Beans and cauliflower *alla Romana* or mushrooms *alla Napoletana* are boiled, drained and heated again in oil. In Austrian recipes cabbage is twice heated or stewed for a very long time : potato balls are made from boiled potatoes, sieved and then baked or fried. In Germany, vegetables and fresh fruit juices for sweet dishes, are heated several times : potatoes *Burgemeister* are boiled, heated in butter and finally fried ; stuffed potatoes are baked, sieved and reheated : globe artichokes with onion sauce are boiled and then baked.

---

[1] *Recipes of All Nations*, compiled by Countess Morphy. (Selfridge.)

Through an extravagance of mis-spent labour and ingenuity the continental cook destroys the vitality of fresh food. The simplicity of English cookery is partly due to laziness and partly to the good quality of the meat and garden produce. Plain roast, plain boiled or plain fried, the material has its own tenderness, succulence and distinctive flavour and does not require to have these virtues artificially bestowed by slow simmering in savoury *ragouts* or to be masked with highly-seasoned sauces. The less handling, heating and beating up with air to which foods are subjected the better is their nutritive value conserved.

Besides over-elaboration other harmful processes have been introduced into this country from abroad : cooking greens with soda to make them unnaturally vivid in colour, and conversely bleaching other vegetables such as celery and salads to a corpse-like whiteness. Fortunately our growers have had the sense not to ruin the flavour and the food value of asparagus by following the French custom of bleaching it. But *The Times* agricultural page (July 1939) published elaborate directions for the bleaching of celery.

The English woman is often rebuked for her increasing reliance on canned foods as saving trouble. Her ready use of the tin opener is even blamed as one of the causes of present-day malnutrition. Much of the prejudice against tinned foods dates from mistakes made when the canning industry was in its infancy, mistakes which have long since been remedied.

---

[1] Chick and Dalyell. *Brit. Med. J.* 1920. ii. 546.

The material for canning is carefully selected and packed under hygienic conditions by a reliable firm and there is less danger of food poisoning (either chemical or due to infection) from canned foods than from fresh material. Used with discretion to compile Square Meals, the tin opener may be a way to health by opening up many inexpensive sources of protein of good quality, of vitamins and of mineral salts.[1]

Corned beef, condensed milk and tinned salmon are cheap and valuable sources of good quality protein and of the vitamin B_2 complex. Tinned salmon is unique among foods for its astonishing richness in vitamin D; the red variety contains 224 international units per ounce as compared with an average of 14 in butter. Canned salmon is also rich in vitamin A. Tinned pilchards, herrings, sardines, brisling are rich in both these vitamins. Sea fish are the best source of iodine.

Canned foods are prepared *in vacuo*; that is in the absence of air, which destroys vitamins by oxidation. For this reason canned foods are superior to domestically cooked foods. The real objection to tinned fruits is that they are as a rule much too highly sweetened. Some of the most popular varieties, such as pears, plums and peaches are poor in vitamin C even in the fresh state. Tests show that there is little loss of antiscorbutic value in the canning of black or red currants, strawberries, oranges, gooseberries, loganberries, raspberries, Brussels sprouts, broad and runner beans, green peas, etc. An important point to remember is that vitamin C is distributed equally between the solid and liquid contents of the tin and the liquor should not be wasted. The juice of canned tomatoes has proved of value in the prevention of infantile scurvy.

All the year round tinned foods offer endless variety and bring into the home the skill of expert chefs. In homes with no costly refrigerator it is an advantage to have foods that keep until they are required. By saving time and fuel canned foods set free money to be spent on improving the quality of the diet.

---

[1] Some of the big distributing combines with multiple shops have been selling as *home produce* dried green peas imported from abroad, boiled, tinted and sweetened in this country before tinning. Foreign varieties of canned salmon are masquerading as Canadian salmon.

FOOD VALUES AND AGRICULTURAL POLICY

The Square Meal and the Feeding of the Nation

BASED on an appreciation of food values and food requirements home produce and food imports could be regulated so as to be supplementary instead of competitive. The bulky perishable foods such as milk, eggs, vegetables, summer fruits, fish and some meat, which help to fill the corners of the Square Meal (frontispiece), are suitable for home production, while the concentrated energy foods that fill the central circle, cereals, seeds, oils for margarine, butter, cheese, sugar, and some more meat would be imported. In winter for satisfactory filling of the corners of the Square Meal, the importation of citrus fruits, tomatoes and early vegetables from warmer countries is required.

Such a scheme has the double advantage of giving our farming industry a definite aim and it prevents the colonies from robbing themselves of their best food to export to Great Britain while their own children are ill-fed.

Instead of the sinking of £ millions annually in subsidies to grow sugar beet and wheat in this country both crops can be better and more cheaply grown abroad and imported. Canada has surplus wheat, and the West Indies surplus sugar, while we spend millions of £ to spoil their livelihood. Moreover sugar is already eaten in harmful excess and the League of Nations' Food Committee advises its decreased consumption and therefore reduced output.

Before and during the Napoleonic wars countries were self supporting for essential foods and at a pinch fed themselves and invading armies. Since the industrial revolution agriculture in this country has declined from the position of leading industry employing most labour to the level of an extravagant hobby which pays no dividend for the £850,000,000 capital said to be invested in it.

Look at the cost of subsidies for 1939[1]

	£ million
Beet sugar	3.0
Cattle industry	4.625
Milk	.493
Bacon	.425
Oats and barley	.930
Herring industry	.073
Land fertility	1.5
A total of	11.046

Let's write it out in full so we realize its awful enormity. £11,046,000 which does not include the subsidy for wheat costing from 1 to 5 £ millions annually. The total expense to the nation of the Government's agricultural policy is said to amount to 40 to 50 £ millions a year.

And what do we get for these vast sums spent on farming? *Do we get cheap food?* No. We pay dearly to buy that which we have been heavily taxed to produce. *Does this costly home produce give us a valuable foundation for feeding the nation in war-time?* No. We are told that if imports are cut off the nation will soon starve.

Food Supply in Time of War

In time of war a secure supply of food is the first line of defence. We need a large reserve of stored food, a nucleus of homegrown food capable of expansion in emergency, command of the sea and air and enough merchant shipping to enable us to import the rest of our food and raw materials.

An isolated country like Great Britain, dependent on sea-borne food and raw materials is obviously at a disadvantage in time of war. Avenues of supply may be blocked or many cargoes destroyed in transit by the enemy.

In the 1914–18 war, shortage of food and not of armaments was the decisive factor. The submarine campaign directed against merchant shipping was at one critical period nearly successful in its object of starving us out. In the nick of time means of circumventing this menace were devised.

Our lines of transport are still vulnerable to attack, even command of the seas may not entirely safeguard merchant shipping from aerial bombing. The sinking of supplies in any future war may seem to the enemy to offer a less bloody and speedier termination than bombing towns or prolonged fighting.

---

[1] *The Economist*, June 10th, 1939, p. 594.

In 1916 after failing in the attempt to starve Great Britain, Central Europe collapsed from the effect of a retaliatory blockade. Their livestock was reduced and for want of manure and nitrogenous fertilizers the crops dwindled in yield. Civilians lost weight, the death rate was very high and every child had rickets. Tuberculosis increased[1] and there were outbreaks of famine dropsy, of *hungermalacia*, a crippling bone disease in adults, and of *xerophthalmia* an inflammatory condition of the eye, all caused by want of food and of fat soluble vitamins in particular. The guns at the front were silenced for want of bread and butter in the home land.

Let us take stock of our assets in food and ships.

Assuming F. Le Gros Clark's figures[2] to be correct, our total home food production is in reality a *minus* quantity, a vanishing illusion in time of blockade. To produce each ton of home grown food we import more than one ton of feeding stuffs (food for animals) and fertilizers (food for the soil).

The question of shipping tonnage is vital. Imports have to be restricted to the tonnage available and in war-time shipping may be lost faster than it can be replaced. Sir Arthur Salter, M.P., Director of Ship Requisitioning in our last war, says that our shipping tonnage is now less than in 1914 and we have four millions more to feed and a growing number of refugees.[3] At the same time there are two million less acres of arable land, and an insufficient number of farm hands, the workers leaving the land at the rate of over 10,000 a year. The importation of feeding stuffs for animals increased from under £100,000 in 1913 to over £7,000,000 worth in 1934.[3]

---

[1] Tuberculosis increased by 65 per cent. in Berlin, and in two French towns occupied by Germans the rise was 101 and 183 per cent.

[2] *Our Food Problem and Its Relation to National Defence.* Penguin Special, No. 532, p. 53, price 6d.

[3] *Nutrition and Public Health*, p. 7. British Medical Association publication, 1939, price 2s. 6d.

Our so-called *home produce* is thus an artifact of subsidies and imported nutriments for soil and livestock. It would save money and set free 4 to 5 million tons of shipping if the whole of the nation's food supply were imported. Our fictitious home produce is a danger as it gives a false feeling of security. Because of its dependence on imports, our home-grown foodstuffs will shrivel and disappear when the need for them is greatest. We may find ourselves very quickly in worse plight than Central Europe in 1919.

Two alternatives offer a solution for the present chaotic system by which the nation obtains its food at such extravagant cost.

(1) Shall all the Food of the Nation be Imported ?

With home food production of negligible value and a bottomless pit for the absorption of subsidies, we should in war or in peace save money and shipping tonnage if the whole of the nation's food were imported. The first alternative is frankly to admit our complete failure as farmers and decide that the nation can live more economically and just as healthily on cheap imported foodstuffs.

In that case the prevention of war-time shortage of food is always to hold within the country a year's reserve of foods selected on a Square Meal basis. In time of peace these food reserves would be gradually released into circulation and new stuff stored, in the same way as the housewife is advised to do for her A.R.P. domestic food store. The cost of storing a year's wheat supply or its equivalent has been estimated by Sir Arthur Salter to be less than 1 per cent. of our present defence expenditure.[1] The cost would be largely recouped from the millions saved on farming subsidies. From the point of view of health the nation would have nothing to lose and much to gain by reliance on imported foods. The price of food would be less and the people would be able to afford more and better food. There is no evidence that imported food is inferior in nutritive value to that grown in Great Britain, and there is evidence of its superiority.

---

[1] Expenditure before outbreak of war, 1939.

A blend of Empire butter from cows[1] on good pasturage in a sunny climate is the best on the market for its content of vitamins A and D. It is superior to English butter which comes from cows living under cloudy skies and exercised, one cannot say *fed*, on permanent pastures in such poor condition that the animals have to rely for their sustenance mainly on roots and commercial cattle foods made from imported seed products.

We like to be sentimental about the immeasurable benefits of fresh cows' milk as food for children. Many healthy children are reared on imported dried milk. Fresh cows' milk has not the miraculous virtues attributed to it. Milk is poor in iron, and even the freshest of cows' milk is very poor in vitamins and needs to be supplemented. The good qualities of milk are unharmed by the processes of drying or condensing and transporting from the antipodes. From dried and condensed milk there is practically no risk of catching the dangerous infections carried by unpasteurized milk. Owing to the unintelligent opposition of Milk Marketing Boards to pasteurization a great deal of liquid milk sold is unsafe for human consumption.

Imported tomatoes, bananas, citrus fruits, apples and salads from sunnier countries are not inferior and often of much higher vitamin value than the produce of English orchards and market gardens. At the annual switch over from imported winter to summer home grown tomatoes the price is doubled and rather than pay such high prices the people go without them.

Imported canned foods offer great variety and with them Square Meals can be constructed.

Wheat expensively produced at home in small fields in a treacherous climate cannot compete with wheat from North America with every advantage of climate and mechanical devices to produce a large yield per man day of labour. Some purists advocate the superior virtues of freshly-ground home-grown wheat, but actually at least half of our costly subsidized wheat is fed to animals and is not used in bread making.

This scheme for complete reliance on imported foods has been set out as a *reductio ad absurdum* to focus attention on the utter irrationality of our existing agricultural methods. As long as *John Bull*, the British Farmer, remains the national symbol, sentiment and tradition make us cling to farming even as an unprofitable and expensive hobby which we cannot afford. Farmers in theory, we are in reality as Napoleon said *a nation of shopkeepers*. As the workers on the land have decreased so have those employed in the uncreative distributing trades increased in the period 1923–35 from $\frac{1}{9}$ to $\frac{1}{6}$ of the total number of insured persons. The distributing trade has become parasitic on agriculture paying large dividends to shareholders in slump or in boom. Prices of fresh foodstuffs have been forced to a level which only the wealthy can afford to pay and the farmer cannot sell all his produce.

---

[1] Pharmaceutical Society data kindly supplied by Dr. Katherine Coward.

A large number of unemployed could be absorbed for work on the land if agriculture returned to its former position as a self supporting industry, with wages and amenities equal to those of other mechanized industries. In Wales farms have been abandoned for want of labour to grow food while in adjoining distressed areas the unemployed want both work and food.

Alternatively to importing the whole of our food supply the need for a saner agricultural programme is obvious.

(2) A Self-contained Agricultural System is Wanted

It is not possible or even desirable to raise in the British Isles enough food for the whole population. For many reasons it is expedient to import large quantities of food and if we continue to supplement imports by home produce there is urgent need for a revision of agricultural policy and method. A saner system of farming would aim at being self-contained, that is crops would be grown and livestock reared within a natural cycle of life and return to the soil (pp. 121–128) without recourse to foreign feeding stuffs and fertilizers. There would then be a tangible asset, a nucleus for expansion in time of war instead of a vanishing illusion when imports have to be curtailed.

If we lived in times of assured peace agricultural practice could be revised according to the scheme already outlined for importing the more concentrated foodstuffs from abroad and producing at home the bulky perishable articles, vegetables, summer fruits, dairy products especially milk, eggs, poultry, pork and fish, all those foods which are best eaten fresh. Then unprofitable ventures with wheat and beet could be scrapped at once and their costly subsidies diverted for the development of a self-contained system of farming.

But under the continual threat of war we dare not rely solely on imported wheat. An agricultural system designed to meet the demands of either peace or war must be very flexible, it must have in fact two-way stretch. Crops must be selected which can be switched over as required for feeding either livestock or human beings. A number of field crops are capable of this two-way stretch: cereals, buckwheat, peas and beans, potatoes, swedes, turnips, green vegetables.

The practicability might be considered of growing more rye instead of wheat. The amount of rye grown is decreasing: in 1937 by 3,000 acres. In this country it is mainly used for feeding animals and as human food is only popular as crisp biscuits. Up to the last century a rye and barley bread was eaten in some country districts. In the Middle Ages rye was the staple bread cereal, mixed with wheat in the south and barley in the north. A delicious bread made from wholemeal rye and malt is still made, from an ancient recipe, by a baker in York. Many varieties of rye bread are in common use in Germany, Holland and Scandinavia. Rye has the advantage over wheat that its germ is less easily removed in milling. In the north of Europe rye is hardier than wheat and gives a more certain yield. Rye has a stiffer straw than wheat and is less easily flattened by wind and rain.

Livestock promote the fertility of the soil and are a good reserve to have at the outbreak of war. In order to support livestock on home-grown food a great increase is necessary in the acreage of arable land and millions of acres of our grassland are reported to be in urgent need of reconditioning. Restrictions in leases prevent the ploughing up of permanent pastures.[1] Grassland can support more livestock if it is ploughed periodically, properly drained and alternated with other crops. On pastures in prime condition the grazing season is prolonged, the need for supplementary feeding stuffs reduced, the health of the herds and the nutritive value of the milk improved. It is estimated that on our present neglected pastures for every gallon of milk produced a cow eats 2 lb. of imported feeding stuffs in winter and 1 lb. in summer.

The animal body is an extravagant mechanism for converting many pounds of feeding stuffs into 1 pound of food for man's consumption. In war-time economy this loss has to be avoided and the slaughter of a large number of animals may be a necessity. Cold storage accommodation or facilities for canning should be prepared in readiness.

---

[1] Since the outbreak of war the Ministry of Agriculture has ordered ploughing of poor grassland.

Cows and sheep fed on grass and roots are less directly competitive with man than pigs and poultry receiving grain as well. The best milch cows and breeding stock should be retained as long as possible and also downland and mountain sheep. A remnant of pigs and poultry can forage in woods and hedgerows supplemented by kitchen scraps, spoiled grain, damaged fruit and vegetables, and the crushed berries of hips, haws and rowans.

Reduction in the head of livestock sets free a great deal of food for human consumption and releases grassland for the plough. Well urinated pastures after ploughing make fertile land for field crops. With the number of pigs reduced, the most valuable part of cereals, the *offals*, can be used in bread making and provide protein of much better quality than in white bread; much smaller additions to the diet in the way of animal protein will then be required. Extermination of rabbits and wood pigeons which are farm pests would increase temporarily the supply of animal protein and prevent wastage of crops.

Finally there is that little used harvest which the sea provides for the cost of reaping. Each year less fish passes through the markets and more and more trawlers are laid up. Most people would like to eat much more fish but the trade has been killed by distributors who forced the price to an impossible level. The practicability might be considered of a system of rapid door to door delivery from the nearest port by fast fleets of motor vans to inland districts. By the time the fish has passed through the markets and reached the shops, it has lost its flavour and freshness. In war-time, if butter and milk are scarce, it is the oily fishes like herrings and pilchards, and fish liver oils that will be the main supply of vitamins D and A. If it were not for the fish and chip shops getting special prices the total quantity of fish eaten would be half what it is.

A great asset in time of war would be increased productivity of the soil following on improved fertility. Measures for promoting fertility independently of imported fertilizers are so important in relation to the quality and quantity of food produced that they are considered in a separate section, the cycle of life.

Finally, here is a shining example from the United States of what can be done to revitalize derelict farmland and create employment without spending public money. Food was produced *by the people for the people* without the intervention of money-sucking distributors. In nine cotton-growing States in the South, there was no mixed farming, cotton was the one crop grown. The soil lost its fertility from producing one crop without rotation (as it has done in the case of our permanent pastures). The limited diet of maize, molasses and fat pork caused heavy mortality from the deficiency disease pellagra (p. 36). The people were ragged, hungry and apathetic. Their condition went from bad to worse whenever there was a slump on the cotton market. Fifty years of work by Government agents and private individuals had failed to break the cotton-growing habit. In 1934 a newspaper started a privately financed PLANT TO PROSPER campaign.[1]

An annual competition was organized with cash prizes to farmers (mostly small-holders) who showed the greatest improvement in their farm lands and in their homes. Each entrant received instructions in *plant to prosper* methods and a minutely detailed farm record book. The movement, supported by other newspapers and radio broadcasting, grew like a snowball. Each year steady progress has been made. In 1938 the competitors brought into cultivation 600,000 more acres of derelict cotton fields and raised 10,000,000 dollars worth of food for themselves, their livestock and the neighbouring towns. The number of livestock that year was increased by 10 per cent. Furniture was repaired and several hundreds of new homes built. The farmers now have money to spend and have revived local trade and prosperity. The practice of soil conservation and home improvement increased the value of their property. The total cash gains from this venture run into millions of dollars and all for a very small initial outlay in advertising and cash prizes.

Does not a similar scheme offer a way of escape from the distressed areas of Wales[2] to adjacent mountains and valleys, where farms are derelict for want of the hands to work them?

Small deserted Welsh farms on shallow soil are unsuitable for tractors. It is estimated that it would take 2,000 men three years to clear the bracken from the fields in Wales alone. Pig running is the cheapest form of labour for eradicating bracken, breaking up permanent pastures, and clearing downland and copses of weeds and brambles. Watering and fencing may be a difficulty. The animals benefit from the open air and exercise and from getting their natural food of bracken roots, beech mast, acorns and berries and require less supplementary foods. The earth is aerated by their rootling and manured and left in a condition ready for sowing with clover and grass.

---

[1] *The Country Home Magazine*, June 1939. The Crowell Publishing Co., 250 Park Ave., N.Y.C.

[2] As a result of malnutrition the infant mortality and still-birth rate in these areas was in 1937 as high as 63 per 1,000 as compared with 3.26 per 1,000 for England and Wales as a whole. The still-birth rate was also high. The provision of extra food to mothers in the Rhondda Valley reduced maternal mortality by 75 per cent.

MALNUTRITION AND THE COST OF LIVING

Malnutrition and the Cost of Food

THE prevalence of malnutrition is closely related to the cost of food. Farmers complain that the problem of increased production is easy to solve as compared with the difficulty of finding a big enough market. That is because the cost of home produce is more than the public can afford to pay ; even the richer classes buy imported foods because they cost less. With prices lower the consumption of home produce would be doubled and trebled. Attempts to increase consumption of home produce by tariffs on imports forces the poorer classes to go without and the farmers gain nothing.

A legacy from the last Labour Government, the Marketing Boards formed to protect the producer have used their powers to squeeze more money year after year out of their customers. No attempt was made by them to create expanding markets by improved methods of production, leading to lowered retail prices and increased turnover. The Marketing Boards eliminated all healthy competition and made it a crime punishable by a fine to sell a large potato or to sell cheap milk. The dairy farmer who by good management produces milk at a low rate per gallon must not let the buyer have the advantage of his skill by reduced prices. The most thriftless and uneconomical farmer must have a guaranteed profit. In a bad season prices are raised still higher but in a good season there is no corresponding fall in retail prices to help the half starved consumer. The members of the Boards are not voluntary but draw salaries from the consumers' pockets.

The Food Council in their Report to the Board of Trade (1939) commented most adversely on the activities of the Marketing Boards and suggested that as the public have to pay the high prices there should be independent control over the efficiency of their methods of production and distribution. The Council advised that retail prices should be competitive and not fixed. The views of the Consumers' Committees are ignored by these "Producer Monopoly" Boards.

The artificial inflation of food prices is one of the chief causes of malnutrition and is responsible also for the failure of the producer to create an expanding market.

The Marketing Boards are not alone responsible for inflated food prices. In fact these Boards originated in the natural desire of the producer to secure more reasonable prices from the distributors.

For fruit, vegetables, fish, sheep and lambs, the producer is badly paid and the consumer highly charged because of the unwieldy overgrowth of the distributing trade with the interposition of innumerable middlemen.

Before 1914 large wholesale provision merchants began to open retail chain stores. New branches quickly established themselves by underselling the small food shops. At first the public profited by the lower prices. In the 1914–18 war the warehouses and distributing mechanism of the large firms were invaluable to the Government for the storage and fair distribution of the restricted food supplies. In the years following the war large firm amalgamated with large firm in ever greater Combines and Price Rings. Chain stores spread all over the country. Local markets selling fresh foodstuffs direct from producer to consumer disappeared and such small shops as survived became merely outlets for the fixed-price *branded* goods of the Combines.

Lordly fortunes were amassed by the chief distributors and some of them were raised to the peerage. These Lords of the Food Trade with huge vested interests behind them may control rather than be controlled by the Government. Moreover by launching advertisement campaigns they influence the public to "Eat More" of some particular commodity without any care as to whether the article boosted is a good food or not.

Since the great Combines became all powerful they manipulated food prices as they chose. Competition was eliminated and food prices were not allowed to drop as did the prices of many other commodities towards the 1914 pre-war level. No longer could the public benefit by lower prices when there was a glut of some perishable article or a bumper harvest. Quantities of food were destroyed rather than cut prices. Any prospect of scarcity led to retail prices being raised in anticipation. It has been aptly said that the slogan of the food trade is to "*Sell a little for a lot*" rather than to "*Sell a lot for a little.*"

In the event of war the storage and distributing mechanism of the great Combines is undoubtedly a valuable national asset which facilitates the smooth working of schemes for rationing essential foodstuffs. But in times of peace the people will continue to be ill nourished as long as the Combines are allowed to manipulate prices by strangling competition and are free to use their immense power for their own gain and not for the welfare of the nation.

If direct contact could be re-established between producer and consumer then the Marketing Boards and Distributing Combines would lose their power to create famine prices for food. A revival of fresh produce markets in this country would make shopping a joyous adventure profitable alike to buyer and seller as it still is in every continental town.

Malnutrition and Housing

The abolition of slum areas and housing schemes for the working classes increases the rent and diminishes the small sum which the working class mother has to spend on food. The effect of rehousing in Stockton on Tees was shown by the late Dr. G. C. M. McGonigle to cause a rise in the death rate of 46 per cent. in the new housing area, that was four times the expected death rate. The rent had been almost doubled and had to be paid for by cutting the food.

An investigation in London County Council new housing areas might reveal a similar state of affairs. To quote what is probably a typical case:

> In central London districts working-class dwellings have been replaced by luxury flats. A family was therefore obliged to shift to an L.C.C. housing estate at Dagenham in Essex. Here they enjoyed better air and sunshine, but the greater part of the family income of £2 10s. 0d. a week went on the high rent and expensive fares for the father to his work in London. The family increased to four children and were compulsorily shifted to a larger house at a still higher rent. All the people of the district were of the same struggling class. The mother had no opportunity of

depositing any of the family in a crèche and taking daily work, as would have been possible in a district where richer and poorer lived side by side. The mother was a skilled cook and very intelligent, but the money available for food was hopelessly inadequate and the family were frequently ill. A son could not take up a scholarship at a secondary school because he developed tuberculosis.

A system of town planning which forces the working classes into outlying districts with high rentals and heavy travelling expenses is designed to create malnutrition.

The Prevention of Malnutrition

The causes of malnutrition are poverty and ignorance of food values. In many cases a large gap exists between the purchasing power of the family and the artifically heightened cost of food. To close this gap many plans have been suggested and perhaps a combination of several methods may eventually succeed in solving the problem. These methods come under three main headings :

1. *More Money to Spend on Food*

Wages + family allowances for married men coming under the national insurance scheme.

In France family allowances have long been paid to the working classes but in this country such allowances are limited to members of the Services (army, navy, etc.) ; to the unemployed ; and to the employees of a few of the more benevolent industrial firms.

A flat rate for rental on Council Housing Estates so that the man with an increasing family compulsorily shifted to roomier quarters is not handicapped by a higher rental.

2. *Cheaper Food*

Methods to reduce the price of food are :

The re-organisation of agriculture to produce more food at less cost.

The elimination of uncontrolled Marketing Boards and of distributors' Price Rings.

The simplification of distribution to reduce costs by cutting out unnecessary middlemen.

Direct delivery from producer to consumer by fleets of producer-owned motor vans; and/or the revival of the old-fashioned market for farm and garden produce.

3. *The Growing of Food by the People for the People*

This could be effected by the organisation of *Plant to Prosper* campaigns (p. 114) to aid the small holder, the land settler, and the allotment owner.

THE PLACE OF FOOD IN THE CYCLE OF LIFE

> "*The land should be properly used to produce the maximum quantity of food without detriment to the health and fertility of the soil.* (Cheers.)"—Sir Reginald Dorman-Smith addresses the House of Commons, June 15th, 1939.

In the measurement of food values by the *yard stick* of Calories per pound, or international units of vitamins per ounce, or the mongrel system of grams per ounce, there is a danger of losing sight of fundamental things. The design on the paper jacket of this prosaic book is a reminder that the strength or energy which food gives us, comes indirectly from the sun through the chemical activity of plants. Green leaves are traps to catch sunlight. Chlorophyll the green pigment in plants uses the sun's energy to construct from water, earth and air the complex substances on which animals feed. Chlorophyll and light work together to build up from simple materials (water, carbon dioxide, oxygen and mineral salts) the elaborate molecules of sugars, starch, oils, proteins and vitamins. In green plant tissues with the help of the red rays of light, carotene, the precursor of vitamin A, is formed. The action of the invisible ultra-violet rays in sunlight falling on the skin of animals converts inactive ergosterol into vitamin D.

There is no elixir of life as the ancients believed. The stuff of which living bodies are made arises from the interplay of sunlight, water, earth and air, which in Aristotle's philosophy were the four fundamental elements. In the action and reaction of these four archaic elements is life. Nutrition is a state of poise, the balance of the living body maintained through ceaseless disturbance and readjustment. Malnutrition is balance upset and not fully compensated.

The body of a man or animal has been likened to a machine but the likeness is only in a similar need for fuel to give energy for heat and movement. A machine has no assimilative power. It can ingest lubricating oil through one slot and coins through another and can after cog agitation disgorge a ticket and the correct change with greater speed than can be achieved by human cogitation. The oil, the coins, the tickets, and the capacity for monetary calculations reside *within* the machine but are not *of* the machine. Apart from wear and corrosion the material fabric of the machine remains unchanged. It has no power of reproduction or of repairing itself after damage. The living organism feeds, grows, repairs itself, reproduces its kind. The substance of its body is in a continuous state of change and flux. Its enduring identity is a permanence of pattern only and not of material; permanence in the pattern of its form and functions: permanence in the microscopic pattern of the tissues and the ultra-microscopic pattern of the proteins of cells and blood. The pattern is passed on to the offspring. Like breeds like and eating mutton will not turn us into sheep.

All the days of our life matter streams through us and from us and only our pattern persists. Matter built from earth, air, water and sunshine is held for a while in the pattern of our bone, flesh, blood and brain, to subserve the purposes of our will. And then matter passes from us again on its perpetual journey, its endless cycle, wheeling from lifeless to living over and over again. From sun and water, earth and air, to leaf and fruit: from grass and seed to flesh and milk: from animal and plant to rational, irrational, scheming man, and back again to earth and water and open air in sunshine. This ceaseless activity is recognized in the words of Krishna the Indian deity: *If I remain at rest for one moment this universe will be destroyed.*[1]

Where does it go to, this wheeling matter that for a while was the instrument of man's mind? Carbon dioxide and water, breathed out from the lungs, pass into the atmosphere and become the food of plants. In a state of nature, leaves and twigs and droppings from men and animals form part of the carpet of the earth and renew its fertility. The earth is not a dead thing but a hive of industry, a commonwealth of moulds, yeasts, bacteria, worms, burrowing insects and animals. Through their agency that which was dead and stinking is transformed without waste into new life.

---

[1] From the Hindu Scriptures (The Bhagavadgita).

In primitive communities this simple life cycle revolves uninterruptedly and the soil is not robbed of its vitality. For forty centuries the Chinese[1] have preserved the fertility of their land by nature's conservative method of returning to it every scrap of animal and plant refuse as manure after predigestion with soil and subsoil. The earth thus enriched supports teeming life. The average figures from seven *rural* areas showed that one square mile of farm land supported the life of 1,783 people and 212 cattle or donkeys and 399 swine.

Not so very long ago Londoners were still part of such a natural cycle. Canal barges brought fruit and vegetables to town and returned laden with cargoes of " night soil " and excrement for the enrichment of the market gardens in the outlying country. A filthy arrangement but more in accord with the conservative economy of nature than our present sanitary system of swilling sewage wastefully and expensively into the sea and wastefully and expensively burning municipal refuse in destructors.

Little of the material taken from the earth is now returned to it. Shakespeare might have been thinking of hygienic modern man when he wrote "*Of his bones are coral made.*" For the substance of our bones is washed into the sea and caught up in the cycle of sea life. It is our flesh which nourishes that too lush growth of seaweed which is an index of the sewage pollution of coastal waters. This overgrowth of seaweed is said to spoil fishing grounds and is an increasing nuisance to holiday makers on the sea-shore near large towns. Where there is no great rise and fall of tide, the sea becomes foul with sewage and spreads disease among bathers.

It is rare nowadays to see fields dotted with heaps of fresh seaweed or with *kelp* made from burned seaweed. In the film *Men of Aran* the islanders are seen using seaweed as manure. Some of the material lost to the land through our wasteful sewage system could be retrieved by harvesting the decaying banks of seaweed on the beaches for use as a fertiliser on inland and upland districts where the iodine and potassium content of the soil is low. Elements needed by the soil in larger amounts are sodium, magnesium, chlorine and sulphur.[1] Seaweed provides these elements as well as valuable nitrogenous material. Salt is helpful to the growth of many crops (but not potatoes). Salt enables the plant to make better use of a limited ration of potassium,[2] a point to bear in mind if war conditions should cut off our imports of potash.

---

[1] *Farmers of Forty Centuries*, by F. H. King, D.Sc., published by Jonathan Cape.

When we become ultra-civilized and flout the fundamental laws of life disharmony is created and disease is the inevitable penalty. The soil in this country has become a playground for commercial interests. Supernumerary factories for the fixation of nitrogen set up during the war (1914–18) to make explosives found a convenient peace-time outlet for their products as nitrogenous manures. Artificial manures are more akin to stimulating *drugs* than to true soil *foods* and are not a biological equivalent for organic composts. Artificial manures can within limits be very beneficial, but require to be dispensed with pharmaceutical care to suit the needs of each particular case.

If the soil is not properly nourished the crop yield is poor and the sickly plants do not resist the attacks of fungi, viruses and insect pests.[3]

Animals and human beings fed on ill-nourished plants are likely to be ill-nourished and subject to disease. When the natural balance is disturbed by withdrawal without repayment, treatment with chemical manures does not fully compensate. The balance is disturbed and the earth itself suffers from malnutrition.

England's once " green and pleasant land " unrolls before the eye of the passing traveller as a succession of dingy fields of dry bents invaded by bracken, ragwort and thistles, or of fields of a more beautiful but equally innutritous blend of ox eye daisies, sorrel and exhausted grass, useless for hay, silage or pasture. It is not surprising that our herds and flocks depend for their food largely upon imported feeding stuffs. The observant motorist cannot but notice the superior fertility and relative freedom from weeds in other European countries due to better cultivation although in Great Britain we have substantial Government subsidies to provide fertilizers and we have more mechanized appliances and no shortage of labour.

---

[1] *Fertilizers in Modern Agriculture*, by Sir E. J. Russell. Bulletin No. 28. The Ministry of Agriculture and Fisheries (publ. H.M.'s Stationery Office), price 4s. July 1939.

[2] *Ibid.*

[3] Sir Albert Howard : *Chemistry and Industry*, LVI, 52, 1937 ; *Empire Cotton Growing Review*, XV, July 1938.

The American Public Health Association reported less loss of fruit from fungi when heat dried activated sludge was used as manure. No cases of illness followed its use.

The money spent on subsidies to farmers for the purchase of chemical manure might yield a better return if spent on encouraging practical schemes and technical researches with the object of the return to the soil of municipal and domestic organic wastes with their nutritive value intact and the risk of infection removed. As importers of so much food for men and animals we have the opportunity of enriching the soil of England with material derived from the earth of other countries.

Some of the more enlightened sanitary authorities are already making manure of the material from drains and dustbins. The problem is complicated by the large and varying amounts of water and fat in the sewage and by the inclusion of chemical wastes from industrial works. It is objected that the problem is different for each district and for the same district at different times and therefore impracticable. But if some sanitary engineers can solve their local problem others could be equally successful. The disposal of sewage and refuse can be a dead loss to the land and to the ratepayers' pockets or it can be a source of income to both. Properly controlled tips[1] and dumps of refuse can be converted into rich stores of humus[2] to increase the fertility of agricultural areas round large towns.[3]

Another method (employed in Southwark and St. Albans and elsewhere) is to pulverize municipal rubbish and sell it to farmers as a humus-forming agent to compost with manure. This saves the cost of expensive patented processes for converting mixed rubbish into humus. Pulverized town wastes rich in cellulose are exactly what is needed for the land, mixed with manure and with urine from cowsheds.[1] In the ordinary manure heap the fumes of ammonia prove that nitrogen is being lost into the air.

---

[1] *Some Notes on the Scientific Aspect of Controlled Tipping*, by Jones and Owen. Pubd. by The City of Manchester.

[2] *Humus* is the dark brown or black material formed by the partial decomposition of vegetable and animal matter. It absorbs moisture and ammonia from the air. On the presence of humus in the soil its fertility depends.

[3] J. A. Coombs (*J. Institute Sewage Purification*, 1936) suggests that the manufacture of organic fertilizers from town garbage and sewage should become a national industry.

Difficulty in breaking down the prejudice of farmers has caused the failure of some pulverizing plants. Education is needed in the best method of applying the material, and composting it in the right proportion with animal manure. The demand by farmers for crushed wastes from Southwark is now exceeding the supply.

The methods of Leatherhead Urban District Council are an example of what can be done to utilize wastes to restore soil fertility. Householders are asked to separate newspapers from house refuse. The paper is collected, baled and sold. Other material which has a marketable value (ashes, tins, rags and bottles) is picked from the moving belt that feeds the pulveriser. The powdered residue is mixed with sewage sludge to make manure, which is sold by contract, after as much as is wanted has been retained for use on ratepayers' land at 7s. 6d. a ton. The chemical analysis of the manure is very similar to a mixture of cow, horse, sheep and pig manure in its organic content and in nitrogen and phosphorus, but is higher in lime and lower in potash than animal manure.

The deficiency in potash could be remedied by adding ash from burnt weeds and the ash of the many dead trees that stand like gaunt skeletons in our neglected fields and woodlands.

Slaughterhouses, factories for canning foods and making jams and pickles have large residues of organic material which sometimes are and always could be returned to the fields after appropriate treatment.[2]

A different problem is the salvage of waste in small rural communities, in temporary holiday, military or refugee camps which have no sewerage or refuse collection. Country districts overcrowded with evacuated children in war-time would come into the same class. In such cases the best solution is offered by suitable adaptations of Sir A. Howard's "*Indore*" process of humus manufacture. This process was devised for the conversion of agricultural waste products in India into manure, on lines suggested by the Chinese system of agriculture and the process of humus formation in the life cycle in the forest. Later the process was successfully adapted for the utilization of town refuse and *night soil* for humus formation.[1]

---

[1] *Methods of using Pulverized Refuse as Humus-forming Agent* were given in a paper read by Sir Albert Howard at the Conference of the Institute of Public Cleansing, held at Scarborough, 1939.

[2] *Canning Practice and Control*, Osman Jones and T. W. Jones, publ. 1937.

On a small scale every gardener and allotment owner can make humus forming composts from house and garden refuse. Waste paper, consisting of cellulose, can also be composted, ashing some of it, if excessive in amount.

Those producers who desire to grow food of the highest nutritive value will be interested in a condensed account of Sir A. Howard's "Indore" process for humus formation.[2]

A layer about six inches deep of mixed vegetable wastes (or pulverized municipal refuse) is lightly covered with about two inches of animal manure followed by a good sprinkling of earth mixed with wood ashes if available. Repeat the sandwich process in 3 : 1 ratio of mixed wastes to farmyard manure until the bed (in heap or drained pit) is 4½ feet thick. The layers must be kept moist but not wet and *well aerated*. The temperature rises to 150° F. and the whole mass is interwoven with a greyish white mycelium (network of fungoid growth). Turn every three weeks and water as necessary. After six weeks the mass has crumbled and turned black. In three months it is like old leaf mould and ready for the land.

Difficulties due to over-acidity, faulty aeration, too much moisture or an unsuitable site may have to be counteracted.

The process is a partial reversal by the fungi and bacteria in the heap of the work of the green leaf, breaking down the substances that were synthesized by means of the energy of sunlight. Soil organisms oxidise the humus into simple substances which are absorbed by the roots of plants.

In the use of town and village wastes for the manufacture of humus, the conversion is carried out in brick-lined pits two feet deep with a capacity of 500 cubic feet and channels for aeration and drainage. The methods of charging the pit and of watering and ripening must be learned from the original paper.[3]

By exhausting the binding humus in the soil, large tracts[4] of wheat-growing lands in Canada and the United States have been turned into desert land. The loose soil is washed away by the rain and scattered by the wind in devastating dust storms. In this case greed for money stopped the cycle of life by taking from the land harvest after harvest without return until all humus was exhausted. That strange conglomerate humus, vitalizes the soil and forms the link between lifeless and living material and protects the earth from erosion.

---

[1] *Nutrition and Soil Fertility*, "New English Weekly," April 6th, 1939. *The Manufacture of Humus by the Indore Process*, Roy. Soc. Arts, publ. 1935. *Manufacture of Humus from Wastes of Town and Village*, J. Roy. San. Inst., 1938, by Sir Albert Howard, C.I.E., M.A.

[2] *Chemistry and Industry*, 1937. LVI, No. 52, p. 1155.

[3] J. Roy. San. Inst., 1938.

[4] 1,000 million acres of land in U.S.A. alone. In Rhodesia and Nyasaland there is similar soil erosion.

Chemical manures do not contribute to humus formation. In the latest official Bulletin on "*Fertilizers in Modern Agriculture*" fertilizers are considered only in terms of added chemicals (p. 124). Composting for humus formation, or the utilization of town wastes as fertilizers of greater biological value than inorganic material is not described. One effect of humus is to promote a longer and more branching root system than in plants relying on chemical manures. In the presence of humus a mycorrhizal, that is root and fungus, association is established. The fine threads of the fungoid network form a living bridge between the humus and the plant. The fungus is rich in nitrogen and its threads are digested by the rootlets and absorbed, thus supplying the plant with material from which to construct protein.

A return to simple conservative methods of farming is the best means of ensuring the fertility of the soil, and in time of war making us independent of imported fertilizers and of feeding stuffs for animals.

Biologists have warned us that variations making for too great efficiency may cause a species to destroy its food and starve itself to death. Methods of food production far removed from the processes of nature may bring the wheel of life to a standstill.

Then let analysis begin
With each respective origin. . . .

The climbing Sun that tells the hour,
The leafy bough, the open flower,
The perilous beauty of a bird,
All are dust and spinning thus
A realm anonymous
Alike to intellect and creed. . . .

And all our intellect is less
Than Cosmos' slightest carelessness. . . .

So much is certain. Out of gloom
Alike the sepulchre and womb,
There shall emerge, there *must* emerge
A goal beyond the mortal urge
That spins the cycle over and over,
Clover and wheat and wheat and clover,
Grasses that feed and grasses fed
By eager and unhappy dead.
Surely a finite finger moves
These patterns to their special grooves. . . .

But let there be a guide and chart
For mind and matter and the heart,
Lest though it break and nations fall,
Cosmos were chaos after all.

Extracts from "This Cosmos" by Minnie Hite Moody published in *The Commonweal*, New York, February 1934.

TABLES

PAGE

1 ENERGY (CALORIE) REQUIREMENT AT DIFFERENT AGES . 132

2 BIOLOGICAL VALUE OF PROTEINS 133

3 20 AND 30 GRAM PORTIONS OF ANIMAL PROTEIN . . 134

4 COMPARATIVE PROTEIN VALUE OF FOODS IN SHILLINGSWORTHS 135

5 COMPARATIVE ENERGY VALUE OF FOODS IN SHILLINGSWORTHS 137

6 ENERGY VALUE OF 1 LB. OF SOME COMMON FOODS . 138

7 CALORIES AND COMPOSITION OF 1 LB. OF COMMON FOODS . 139

8 FOODS RICH IN CALCIUM, PHOSPHORUS, IRON . . 143

9 COMPARATIVE VITAMIN A VALUE OF FOODS . . . 144

10 COMPARATIVE VITAMIN B1 VALUE OF FOODS . . . 146

11 COMPARATIVE VITAMIN C VALUE OF FOODS . . . 148

12 COMPARATIVE VITAMIN D VALUE OF FOODS . . . 150

13 AVERAGE VITAMIN CONTENT PER OZ. OF COMMON FOODS 152

14 VITAMINS AND MINERALS IN SALADS AND SAUCES . . 153

COLOURED CHARTS

PAGE

Composition, energy and vitamin value of

1 to 5 Meat . . . . . . 155 to 159
6 to 8 Fish . . . . . . 160 to 162
9 Milk, Cream 170
10 to 11 Cheese and eggs 164, 165
12 Fats and oils 166
13 to 14 Cereals 167, 168
15 Starchy foods 169
16 Sugary foods 170
17 Dried pulses 171
18 Nuts 172
19 to 20 Fresh fruits 173, 174
21 Dried fruits 175
22 to 25 Vegetables . . . . . 176 to 179
26 Changes in the diet as weekly income rises . 180

0·75 Adult over 65 years

0·83 Adult Woman

1·05 Girl 14 to 18

1·0 Man (Standard) . Pregnant Woman

1·25 Boy 14 to 18. Nursing Mother

1·0 Child age 12 to 14

0·9 „ „ 11 „ 12

0·8 „ „ 9 „ 11

0·7 „ „ 7 „ 9

0·6 „ „ 5 „ 7

0·5 „ „ 3 „ 5

0·4 „ „ 2 „ 3

0·3 „ „ 1 „ 2

0·2 „ „ 0 „ 1 *

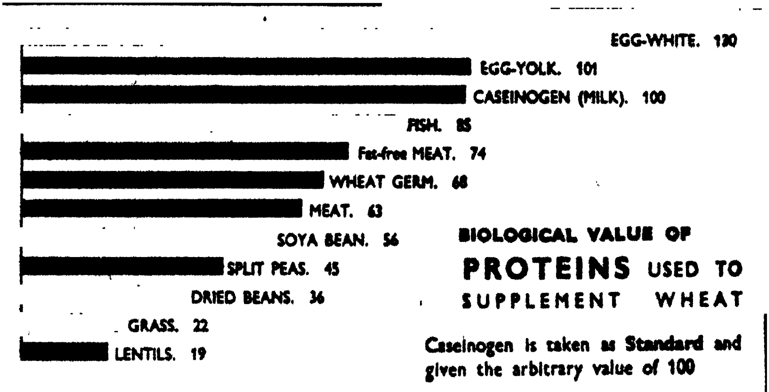
1000 Calories	2000 to 1700	3000 to 2400	4000 to 3000	5000 to 4000

The higher Calorie Values are for Active and the lower for Sedentary life

ENERGY (Calorie) REQUIREMENT at DIFFERENT AGES as compared with Standard Adult Man

TABLE 1.

* A baby's calorie requirement is better reckoned as 100 Calories per Kilo. (=2.2 lb.) of body weight.



BIOLOGICAL VALUE OF PROTEINS USED TO SUPPLEMENT WHEAT

Caseinogen is taken as Standard and given the arbitrary value of 100

TABLE 2

TABLE 3

20 and 30 GRAM PORTIONS OF ANIMAL PROTEIN.

Showing the weight of foodstuffs required and the cost at London shop prices (1934-5)[1]. Values to nearest ¼d. and ¼ oz.

Foodstuff		*Price*	20 g. Wt.	*Portion* Cost	30 g. Wt.	*Portion* Cost
Corned Beef ...	... per lb.	6d.	2½ oz.	1d.	3¾ oz.	1½d.
Cheese (imported)	... ,,	6d.	2¾	1	4¼	1¾
Salmon, canned	... ,,	9d.	3¼	2	4¾	3
Herring, fresh ...	... ,,	7d.	4¾	2	7	3
Butcher's Mince	... ,,	8d.	4¼	2¼	6¼	3¼
Condensed Milk, unsweetened		6d.	8¼	3¼	12½	4¾
Lean Meat (average price)[2]			4¼	3¼	6¼	5
Milk, summer price, per quart		6d.	21	3¼	31½	5
Cod, flesh ...	... per lb.	12d.	5¼	4	8	6
Streaky Bacon...	... ,,	10d.	7	4½	10½	6½
Eggs, 1½d. each	... ,,	12d.	6½	5	9¾	7¼

50 g. is the minimum daily ration of animal protein for 1 Man (British Medical Association STANDARD).

With the help of the above Table the 50 g. can be apportioned as desired. For example :

3¼ oz. canned salmon + 4¼ oz. cheese ... ... Cost 3¾d.
½ pt. milk + 1½ oz. cheese + 3½ oz. herring + 3¼ oz. lean meat ... ... Cost 6¼d.
3 large eggs + 3¾ oz. corned beef ... ... Cost 6½d.
5¼ oz. cod flesh + 4¼ oz. condensed milk + 3½ oz. bacon + 1½ oz. cheese ... ... Cost 8¼d.

---

[1] Relative costs little changed by all round rise in prices between 1935-39, except that cheese has risen by 2½d. and most other foods by 1½d. per lb.

[2] This is the average for *lean* meat, exclusive of fat, from leg of mutton (New Zealand) and leg of pork at 1s. per lb. for the whole joint.

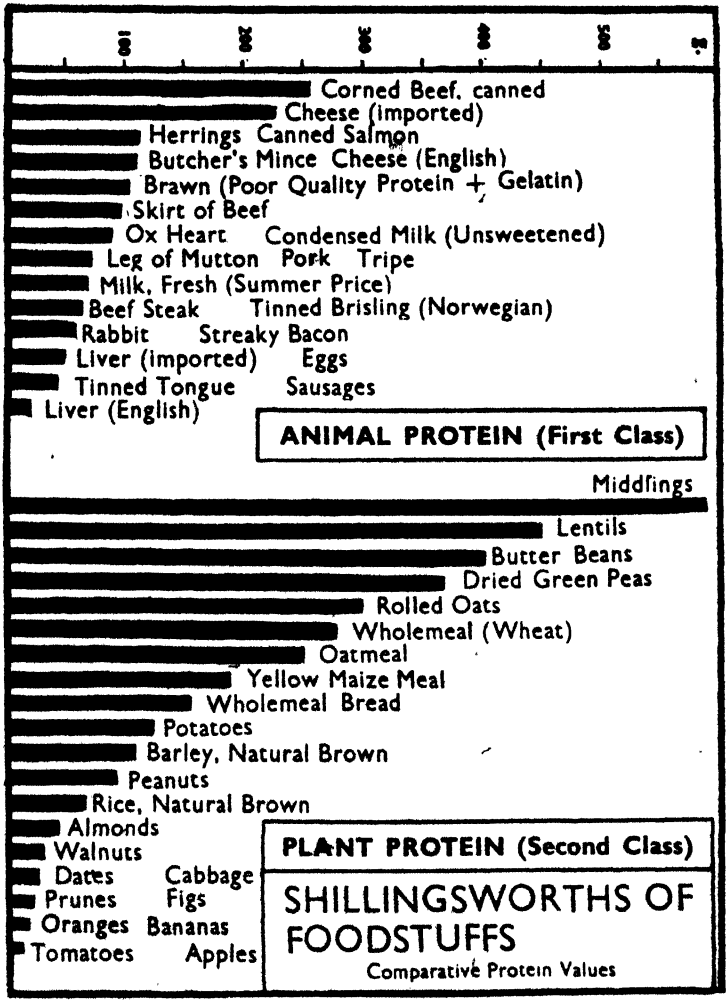
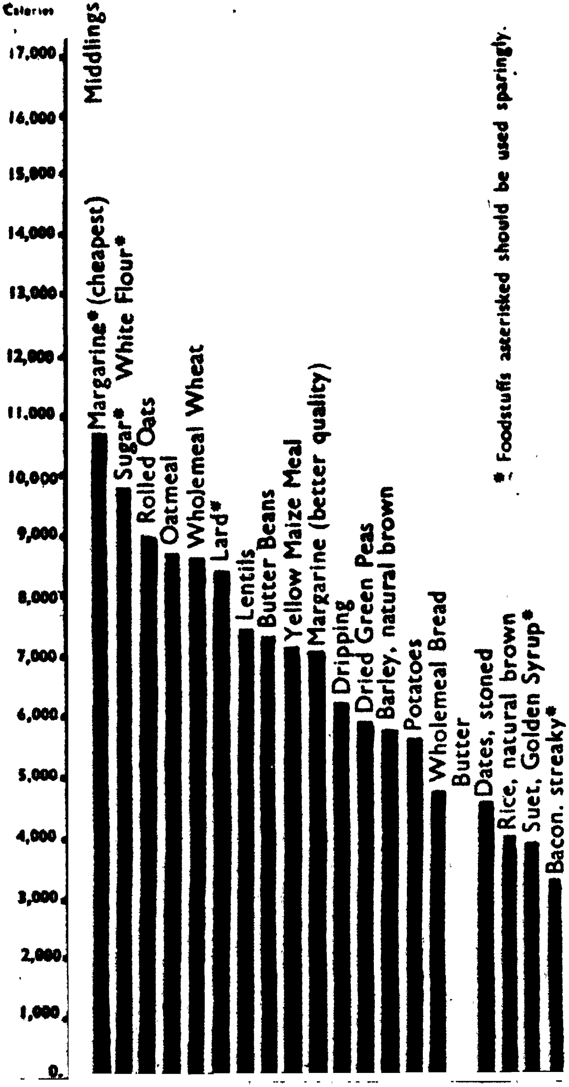

100
200
300
400
500
Corned Beef, canned
Cheese (imported)
Herrings Canned Salmon
Butcher's Mince Cheese (English)
Brawn (Poor Quality Protein + Gelatin)
Skirt of Beef
Ox Heart Condensed Milk (Unsweetened)
Leg of Mutton Pork Tripe
Milk, Fresh (Summer Price)
Beef Steak Tinned Brisling (Norwegian)
Rabbit Streaky Bacon
Liver (imported) Eggs
Tinned Tongue Sausages
Liver (English)
ANIMAL PROTEIN (First Class)
Middlings
Lentils
Butter Beans
Dried Green Peas
Rolled Oats
Wholemeal (Wheat)
Oatmeal
Yellow Maize Meal
Wholemeal Bread
Potatoes
Barley, Natural Brown
Peanuts
Rice, Natural Brown
Almonds
Walnuts
Dates Cabbage
Prunes Figs
Oranges Bananas
Tomatoes Apples
PLANT PROTEIN (Second Class)
SHILLINGSWORTHS OF FOODSTUFFS
Comparative Protein Values

TABLE 4

TABLE 5



* Foodstuffs asterisked should be used sparingly.

TABLE 5.

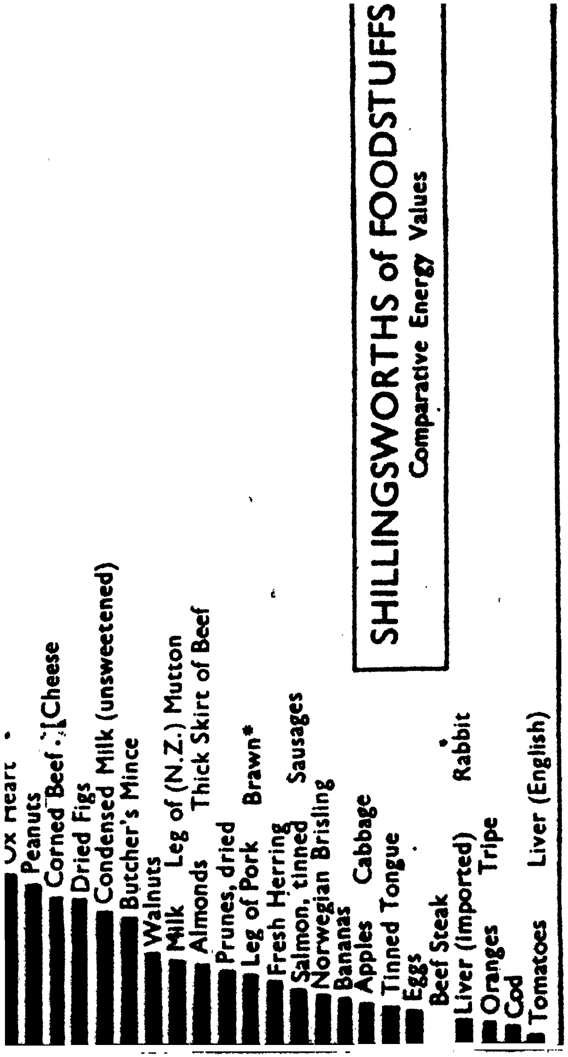
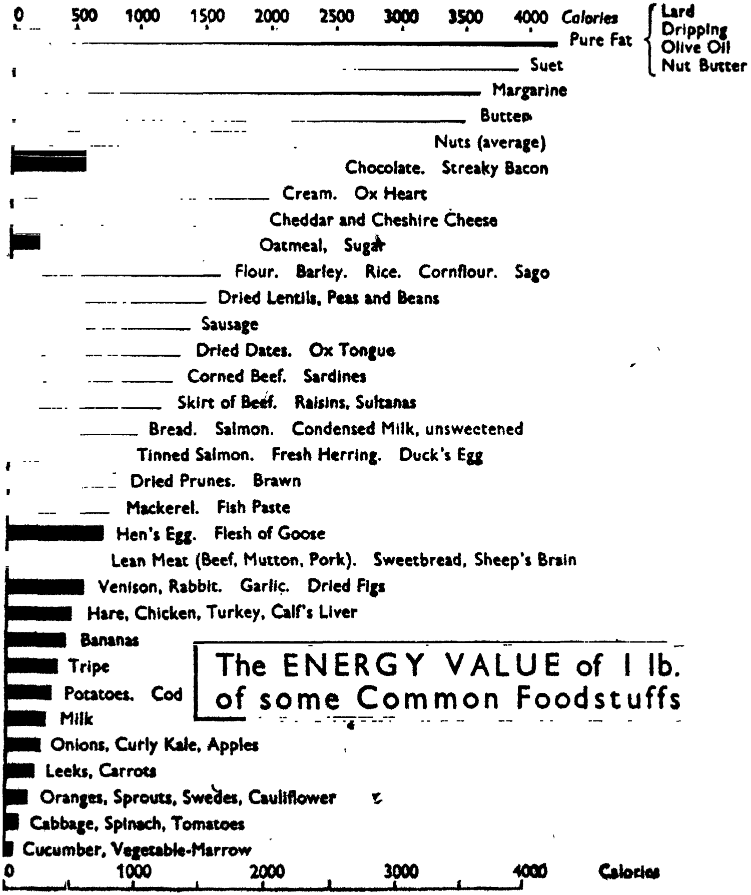

SHILLINGSWORTHS of FOODSTUFFS
Comparative Energy Values

TABLE 6



The ENERGY VALUE of 1 lb. of some Common Foodstuffs

CALORIES AND COMPOSITION IN GRAMS OF 1 LB. OF COMMON FOODSTUFFS.

Foodstuffs.	*Calories.*	*Protein* *A.**	*P.**	*Fat*	*Carbo-hydrate*
Meat.		g.	g.	g.	g.
Beef Steak	715	100	—	31	—
Butcher's Minced Meat	1505	74	—	128	—
Leg of Mutton, whole	1501	74	—	128	—
Leg of Pork	1262	74	—	54	—
Lean of Beef	618	100	—	23	—
,, Veal	493	93	—	11	—
,, Mutton	688	95	—	31	—
,, Lamb	630	93	—	29	—
,, Pork	612	85	—	29	—
,, Meat, average	608	93	—	24	—
Brain, Sheep	684	48	—	48	—
Heart, Sheep	430	71	—	8	13
Heart, Ox	1974	60	—	185	2
Kidney, Ox and Sheep	450	80	—	14	—
Liver, Sheep	573	95	—	13	11
Liver, Calf	504	66	—	4	47
Sweetbread, Calf's Pancreas	684	100	—	29	—
Tongue, Ox, Fresh	1100	71	—	85	—
Tongue, Ox, Canned	1340	88	—	105	—
Tripe, Ox,	382	72	—	9	—
Thick Skirt of Beef	1175	84	—	89	—
Bacon, Streaky	2478	46	—	246	—
Brawn	840	71	—	51	14
"Breakfast" Sausage	1420	51	—	99	71
Corned Beef	1280	128	—	82	—
Ham, slices	2206	57	—	173	—
Pork Pie	1670	34	11	113	142
Sausages	1238	51	—	80	69
Sausage Roll	2340	29	11	166	153
Veal and Ham Pie	1852	41	13	113	165
Poultry, Game, Eggs					
Chicken, Turkey, flesh	515	100	—	11	—
Rabbit, Hare, flesh	550	105	—	13	—
Hen's Egg, with shell	659	50	—	46	6
,, without shell	734	54	—	48	7
,, yolk	1730	71	—	150	8
,, white	229	77	—	—	8
,, Eggs, Dried	2598	183	—	179	43

**A = Animal.* *P = Plant.*

The Protein, Fat and Carbohydrate figures in Table 7 are given to the nearest whole number. For greater precision the Calorie values are calculated from Protein, Fat and Carbohydrate figures taken to first decimal point.

TABLE 7 (*Continued*)

Foodstuffs.	*Calories.*	*Protein*		*Fat*	*Carbohydrate*
		*A.**	*P.**		
Cod, flesh only	330	80	—	—	—
Herring, fresh, whole	662	69	—	49	—
Herring, fresh, flesh only	920	82	—	62	—
Kippered Herring	978	85	—	68	—
Haddock, dry smoked	377	91	—	—	—
Salmon, fresh, Scotch	1012	88	—	74	—
Salmon, canned, Pacific	915	100	—	54	—
Sardines	1257	85	—	95	—
Roe, Cod's, hard, fresh	354	77	—	3	—
Roe, Herring's soft, fresh	868	105	—	45	—
Lobster, flesh only	415	89	—	1	9
Oyster, flesh	370	40	—	4	39
Scollop, edible part	378	79	—	2	8
Milk and Dairy Produce					
Milk, Human	310	9	—	17	29
„ Cow's fresh, per lb.	303	15	—	16	22
„ „ per pint	378	19	—	20	27
„ „ dried, full cream	2126	110	—	110	159
„ „ condensed, unsweetened	976	37	—	54	65
„ „ „ sweetened	1712	45	—	62	236
Cheese, Stilton	2341	119	—	194	11
„ Cheddar	1939	113	—	150	14
„ Little Wilts	1747	100	—	137	14
Fats					
Butter	3503	1	—	376	—
Clotted Cream, "Devonshire"	2416	31	—	264	9
Dairy Cream (average)	—	—	—	—	—
Dripping, Lard, Nut Butter, Olive Oil	4218	—	—	454	—
Suet	3958	3	—	426	—
Margarine (average)	3579	1	—	386	—
Bone Marrow (veal)	3006	23	—	312	—
Bread, Cake, Cereals, etc.					
Bread, wheat, average	1014	—	31	1	215
Biscuits (average, mixed)	2050	—	43	46	335
Biscuits, plain	1673	—	57	3	344
Cake, fruit	1566	—	17**	46	261
„ sponge	1536	—	32**	17	282
Custard Powder	1599	—	—	—	389
Flour, wholemeal, wheat	1639	—	53	9	326
„ white „	1660	—	50	6	345
Bran, wheat	1511	—	64	18	262
Germ, wheat	1719	—	110	34	232

*A = *Animal.* P = *Plant.*

** Contains some animal protein.

Foodstuffs.	*Calories*	*Protein* *A.**	*P.**	*Fat*	*Carbo-hydrate*
Cereals, etc.					
Middlings, wheat	1652	—	56	5	336
Macaroni (average)	1656	—	53	1	348
" Shredded Wheat "	1674	—	44	5	352
" Grape Nuts "	1687	—	43	2	363
Barley, pot	1650	—	32	4	362
Barley, " Kernels "...	1655	—	36	6	353
Cornflour (maize)	1648	—	4	—	397
Maizemeal, yellow	1712	—	45	9	351
Oatmeal (average)	1866	—	54	38	315
Rolled Oats (average)	1809	—	59	29	315
Rice (average)	1640	—	30	2	368
Rye Flour	1682	—	31	5	368
Sago, Tapioca (mean)	1656	—	1	2	399
Sugar, Jam, etc.					
Sugar, white	1860	—	—	—	454
,, brown	1823	—	—	—	444
Golden Syrup	1427	—	—	—	347
Black Treacle	1118	—	1	—	272
Honey	1335	—	2	—	324
Jam and Marmalade (average)	1296	—	1	—	315
Chocolate (average)	2515	—	22	141	271
Cocoa (average)	2215	—	82	121	183
Dried Pulses					
Beans, Butter	1532	—	84	3	282
Beans, Haricot	1552	—	81	2	293
Lentils, red split	1579	—	91	2	290
Lentils, whole	1595	—	97	3	286
Peas, green, whole	1467	—	92	3	259
Peas, yellow, split	1576	—	92	3	286
Peanuts or " Ground-Nuts," kernels ...	2793	—	91	—	100
Pork and Beans, Tinned	751	—	37**	23	96
Nuts					
Almond, kernel	2900	—	92	246	70
Brazil, kernel	3366	—	60	319	37
Chestnut, kernel	1032	—	14	9	218
Coconut, flesh	2267	—	19	220	35
Hazel, kernel	3178	—	60	287	65
Walnut, kernel	3314	—	62	301	63

**A* = *Animal.* *P* = *Plant.*

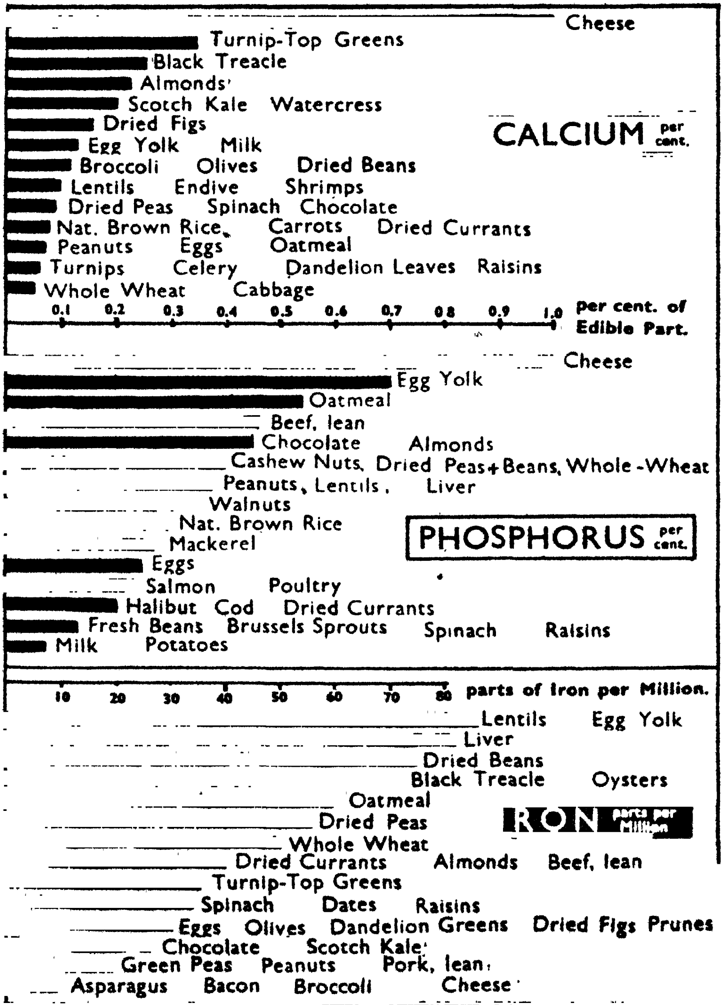
** Contains some animal protein.

TABLE 7 (*continued*)

Foodstuffs.	*Calories.*	*Protein* *A.**	*Protein* *P.**	*Fat*	*Carbo-hydrate*
Vegetables, Fresh, raw, per lb. as purchased allowing for waste in preparation.					
Artichoke, Jerusalem	360	—	7	—	79
Beans, Broad	177	—	11	—	31
Beans, Green Runner	93	—	5	—	16
Beetroot	142	—	5	—	28
Cabbage and other Greens...	88	—	3	—	18
Carrots	205	—	5	—	43
Cauliflower	80	—	4	—	14
Celery	76	—	2	—	15
Cucumber	42	—	2	—	7
Garlic	578	—	19	—	121
Leek	98	—	5	—	19
Lettuce	41	—	3	—	5
Marrow	48	—	2	—	10
Mushroom	119	—	19	1	8
Onion	219	—	6	—	47
Parsnip	385	—	7	2	83
Peas, Green	172	—	10	1	29
Potatoes, new	410	—	7	—	92
Potatoes, old	373	—	9	—	82
Rhubarb	68	—	2	—	14
Spinach	59	—	5	—	8
Swede Turnip	145	—	4	—	31
Turnip, white	95	—	5	—	18
Tomato	101	—	3	—	20
Watercress	60	—	3	—	10
Fruits, Dried, 1 lb. as purchased allowing for waste, stones, etc.					
Apple Rings...	1134	—	4	3	266
Apricots	1037	—	25	1	225
Dates...	1131	—	6	—	268
Figs	1109	—	9	2	256
Candied Peel (mixed)	1252	—	1	—	303
Prunes	685	—	11	1	154
Raisins, Currants, Sultanas, mean ...	1090	—	8	1	254
Fruits, Fresh, 1 lb. as purchased allowing for waste of stone, peel, etc.					
Apples	196	—	1	1	44
Bananas	279	—	3	—	64
Blackberries...	162	—	6	1	32
Cherries	227	—	3	—	51
Currants	146	—	5	—	29
Gooseberries...	128	—	3	—	27
Grapes	261	—	3	—	60
Lemon	31	—	1	1	4
Orange	137	—	3	—	30
Pear, Pineapple	146	—	1	—	34
Plum and Damson	156	—	2	1	33

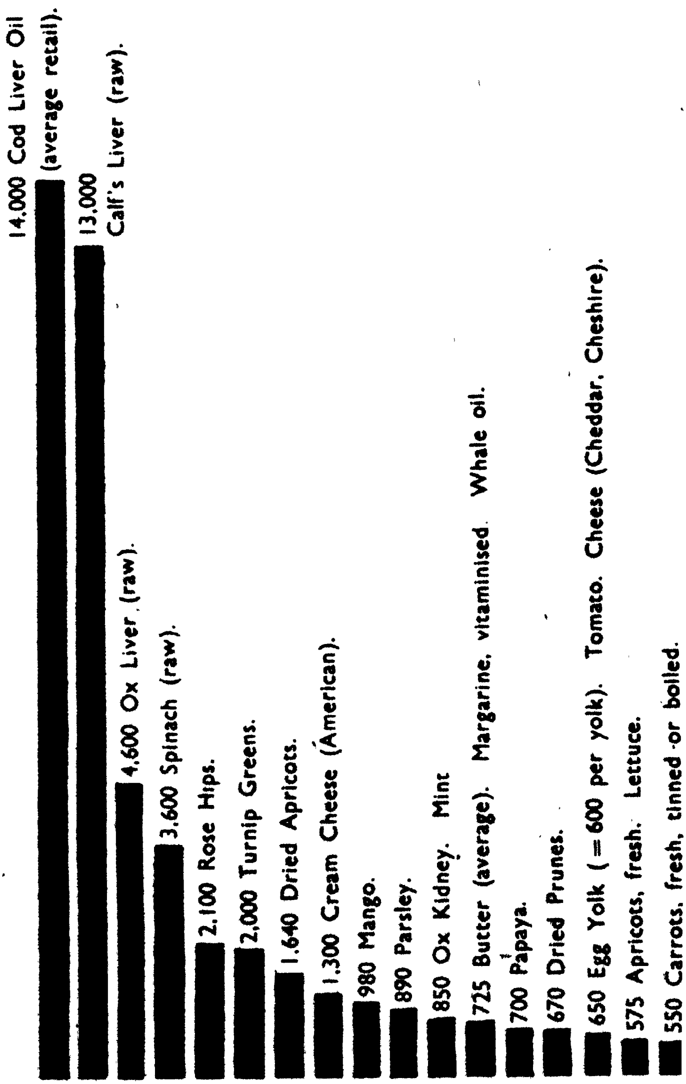
**A* = *Animal.* *P* = *Plant.*

FOODS RICH IN CALCIUM (LIME), PHOSPHORUS AND IRON



Diagrams Represent Average Relative Values. The Mineral Content of Foodstuffs varies greatly according to Soil, etc.

TABLE 9


14,000 Cod Liver Oil (average retail).
13,000 Calf's Liver (raw).
4,600 Ox Liver (raw).
3,600 Spinach (raw).
2,100 Rose Hips.
2,000 Turnip Greens.
1,640 Dried Apricots.
1,300 Cream Cheese (American).
980 Mango.
890 Parsley.
850 Ox Kidney. Mint
725 Butter (average). Margarine, vitaminised. Whale oil.
700 Papaya.
670 Dried Prunes.
650 Egg Yolk (= 600 per yolk). Tomato. Cheese (Cheddar, Cheshire).
575 Apricots, fresh. Lettuce.
550 Carrots, fresh, tinned or boiled.

250 Cabbage, young, green, fresh or boiled.

225 Bone Marrow. Soya Bean. Yellow Maize (American).

200 Peas, fresh, green. Beef Suet or Fat. Nectarines.

180 Wheat Germ. Runner Beans 170.

140 Mutton Fat. 120 Fresh Milk. (Jersey cows, average of winter and summer).

110 Gruyère Cheese. Oyster (whole). Pecan Nut. Peach (yellow). Wheat, Middlings.

85 Salmon, tinned, red. Orange. Blackberries. Asparagus Semolina.

75 Milk, pasteurised (average of winter and summer).

55 Gooseberries. Parsnip. Dried Dates. Guava, Tamarind. Yellow Maize, African. Whole Wheat.

40 Lentils.

28 Dried Sultanas. Pineapple. Bananas. Blackcurrants. Guava.
Figs, fresh or dried. Grapes. Sardines (25).

'ITAMIN A VALUES IN INTERNATIONAL UNITS PER OUNCE OF FOOD

Halibut Liver Oil, 4,500,000 I.U. per oz. (=about 3,200 I.U. per drop.)

Cod Liver Oil, pure fresh, average 56,000 I.U. per oz.

" " " average retail 14,000 I.U. per oz.

FOODS CONTAINING LITTLE OR NO VITAMIN A.

white. Flesh of white fish. Lean meat.
d. Bacon fat. Pork fat. Vegetable oils such as almond, coconut, cotton seed, yellow olive oil. Milk butter and cream
n stalled cows receiving foods poor in vitamin A such as oil cake, hay and roots.
ite cereals or starchy foods such as sago, tapioca. Sugar. Dried beans except soya beans, mangolds, old potatoes, bleached

TABLE 10

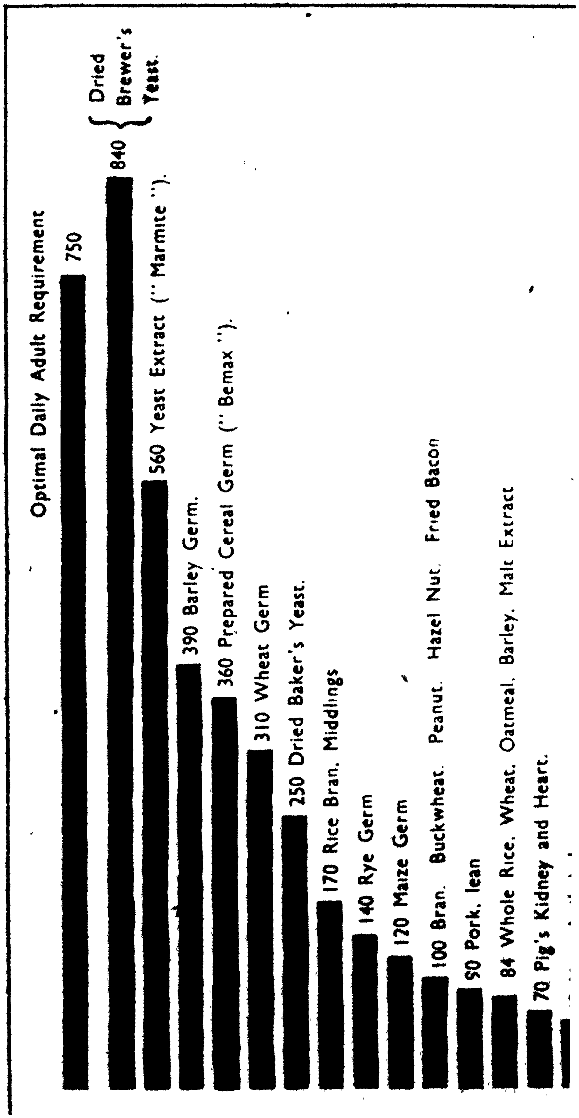
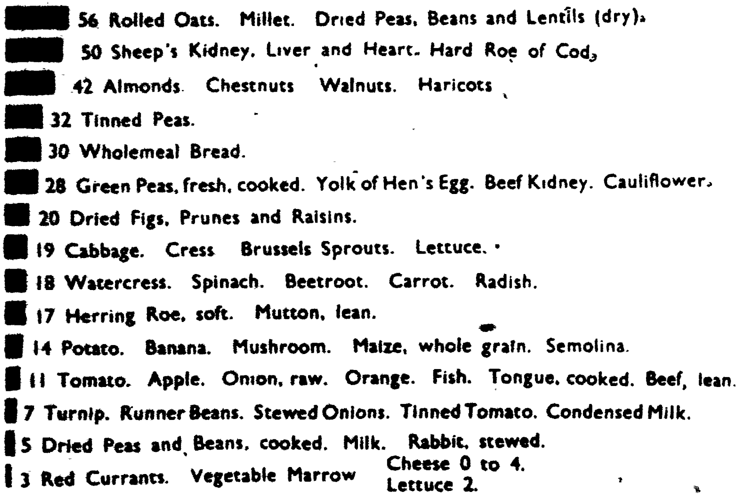

Optimal Daily Adult Requirement
750
840
Dried Brewer's Yeast.
560 Yeast Extract (" Marmite ").
390 Barley Germ.
360 Prepared Cereal Germ (" Bemax ").
310 Wheat Germ
250 Dried Baker's Yeast.
170 Rice Bran, Middlings
140 Rye Germ
120 Maize Germ
100 Bran. Buckwheat. Peanut. Hazel Nut. Fried Bacon
90 Pork, lean
84 Whole Rice, Wheat, Oatmeal, Barley, Malt Extract
70 Pig's Kidney and Heart.

TABLE 10

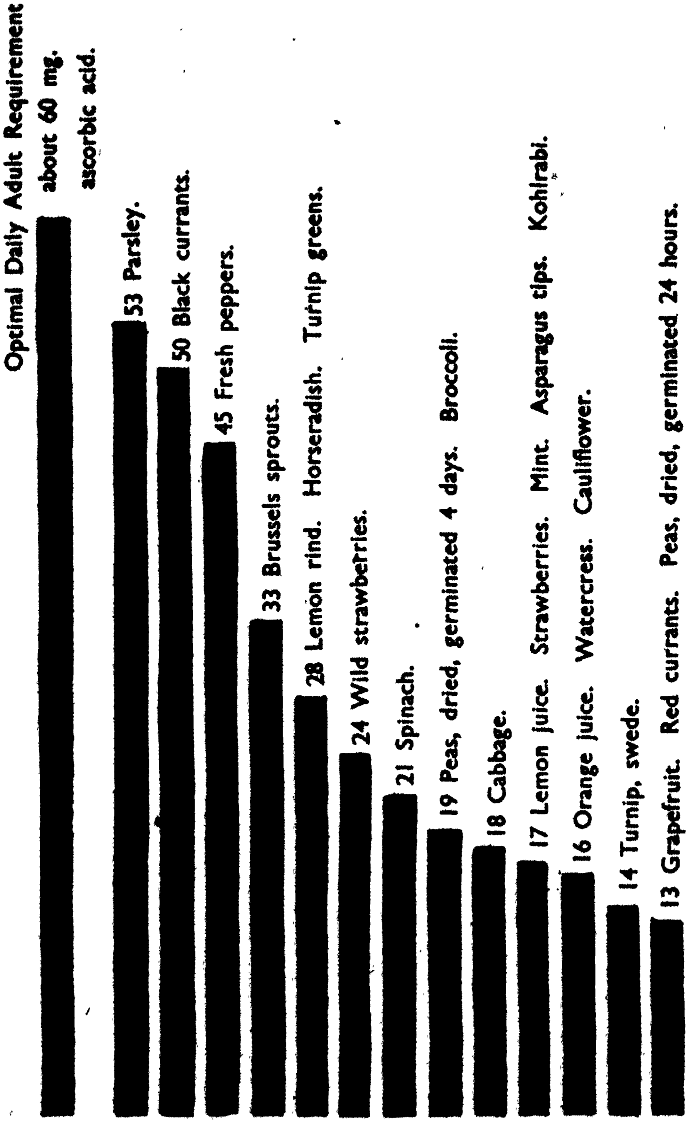


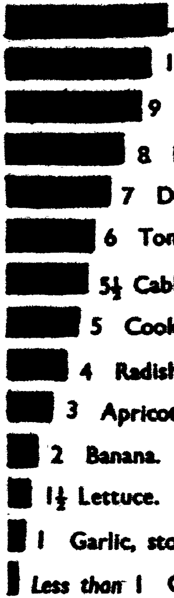
VITAMIN B_1 IN INTERNATIONAL UNITS PER OUNCE OF FOOD

Foods, raw unless otherwise described.
Cereals loose value on storage.

here is little or no vitamin B_1 in Red Currants. Celery, Rhubarb, Vegetable Marrow, White Bread, Over-milled Cereals, apioca, Sago, Coconut, Chocolate, Honey, Sugar, Fats and Oils, White of Egg.

TABLE 11


Optimal Daily Adult Requirement about 60 mg. ascorbic acid.
53 Parsley.
50 Black currants.
45 Fresh peppers.
33 Brussels sprouts.
28 Lemon rind. Horseradish. Turnip greens.
24 Wild strawberries.
21 Spinach.
19 Peas, dried, germinated 4 days. Broccoli.
18 Cabbage.
17 Lemon juice. Strawberries. Mint. Asparagus tips. Kohlrabi.
16 Orange juice. Watercress. Cauliflower.
14 Turnip, swede.
13 Grapefruit. Red currants. Peas, dried, germinated 24 hours.



11	Spanish chestnut. Oats, sprouted 5 days. Celery leaves.
10	Gooseberries. Ox liver.
9	Loganberries. Apple peel. Seville bitter orange. Kale. Calf's liver.
8	Raspberries. Pineapple. Tangerine. Broad beans.
7	Dandelion leaves. Garlic, fresh. Pig's liver.
6	Tomato. Parsnips. Green peas. Leeks. New potatoes. Chicken's liver.
5½	Cabbage, boiled ½ hour with no soda.
5	Cooked turnip, swede. Rhubarb. Flesh of Apple (Bramley-seedling). Ox heart. Pig's brain.
4	Radish. Aubergine (Egg plant). Pig's kidney. Salmon roe.
3	Apricots. Runner beans. Old potatoes. Ox pancreas.
2	Banana. Cherries. Cucumber. Onion. Cooked green corn cob. Carrot. Goat flesh.
1½	Lettuce. Canned spinach. Canned peas. Melon. Beetroot. Whole oats. Human milk.
1	Garlic, stored. Apple flesh (not Bramleys). Chicken flesh.
Less than 1	Grapes. Pears. Plums. Cows' milk.

VITAMIN C VALUES IN MILLIGRAMS ASCORBIC ACID PER OUNCE OF FOOD

1 mg. Ascorbic Acid = 20 International Units.
Foods, raw unless otherwise described.

VITAMIN D VALUES OF FOODS AND FISH OILS.

	International Units per Ounce.
Tunny liver oil	800,000
Halibut liver oil	72,000
Cod liver oil	3,550
Herring, body oil	2,800
Sardine, ,, ,,	2,240
Salmon, ,, ,, from canned fish	1,620
Eel, ,, ,, Australian	1,316
Turbot, ,, ,,	840
Salmon, canned, flesh, red variety	224
,, ,, ,, pink ,,	196
,, ,, ,, variety Chum or Chinook	42
Sea Lamprey, flesh	110
River Lamprey ,,	33
Irradiated yeast	75,000
Cacao shell residues + yeast growth	840
Red Palm oil	110
Egg yolk	90
Olive oil, hemp seed oil, peanut oil	0
Margarine, vitaminised, equal to or better than the best butter	25
Margarine, made from hardened vegetable oils and not vitaminised	0
Butter, Empire blended, average	25
,, average	14
,, English dairy, average	7
,, Danish varies	from 0 to 0.8
Cream, English, fresh	14
Milk, American summer	0.8
,, ,, winter	0.08
,, ,, pasteurized	0.4
,, ,, tinned, evaporated	0.5
Edible fungi (but not mushrooms which = 0)	14
Ox and pig liver, American	12
Calf's liver ,,	2.8
,, ,, English, fresh, June	0

	International Units Per Ounce.
Oyster, clam	1.4
Whale oil, Lard, Egg White, Veal flesh Honeycomb, Mushroom, Mango, Pea	0

The above figures are the average. Animal products vary according to the food and the amount of sunshine to which the animals are exposed.

Butter	varies from	0 to 36.4	I.U., vitamin D per ounce
Milk	„ „	0 to 1.0	„ „ „ „

Butter, milk, cream, eggs have higher values in summer than winter. Comparatively few foods contain vitamin D but many contain traces of ergosterol which becomes activated in the body if the skin is exposed to sunlight. No data exist as to the ergosterol value of foods. Red palm oil is the only vegetable oil containing a considerable amount of vitamin D and the value of the red oil is destroyed by commercial processes to bleach or harden it.

TABLE 13.

VITAMIN CONTENT IN INT. UNITS OF COMMON FOODSTUFFS

Average Content of Vitamins per ounce of food	*A*	*D*	*B_1*	B_2 Complex *B_2*	 *B_5*	 *B_6*	*C*	*E*
Milk	75-120*	0.7	5	+	+	+	less than 1	
Egg Yolk (600 per yolk) ...	650	90	28	+	++	+		
Cheese, cheddar, cheshire...	650	+?	2					
Lean of Meat, cooked ...	14		8	++	++	+++	trace	
Lean of Pork, Ham, Bacon			60–90?					
Liver, ox, calf, pig ...	4,600–13,000	0.3–12.0	40				6 to 9	
Herring, fresh	+?	(400?)		++	0	++++		
Salmon, canned	22–85	200		++	0	++++		
Sardines ,, ...	22	(300?)		++	0	++++		
Cod or white fish				++	0	++++		
Butter or Vitaminised Margarine	725	14						
Suet, dripping, meat fat ...	150	±						
Bread and flour, white ...				0	0	0		
Bread wholemeal	+		30	+	++	++		+
Flour wholemeal ...	55		80	+	++	++		+
Oatmeal	?		80					
Potatoes, boiled	11		10				old 2 to 4 new	
Greens, boiled without soda for ½ hr.	250		15				5	+
Carrot	556		1	+++	+++	+++	2	
Orange	85		11				16	
Tomato	650		11	+			6	
Apple			11				1	
Banana	28		14				2	
Sugar	0	0	0	0	0	0	0	0

*Milk .75 int. Units vitamin per oz. pasteurized milk, average for year. 120 int. units vitamin A per oz. fresh milk from Jersey cows, average for year.

TABLE 14

VITAMINS AND MINERALS IN INGREDIENTS OF SALADS AND SAUCES

	Vitamin A *Int. Units per oz.*	*Vit. B_1* *Int. Units per oz.*	*Vit. B_2 Complex* *Int. Units per oz.*	*Vit. C.* *mg. ascorb. acid per oz.*	*Ca.* *mg. per oz.*	*P.* *mg. per oz.*	*Fe.* *mg. per oz.*
Beetroot ...	0	18	+	1.5	8	10	0.2
Cabbage, raw, green	250	22	+	18	spring 8	9	0.13
,, ,, bleached	0	16			winter 16	4	0.13
Carrots, young ...	550	18	+	2	8	8	0.12
Cauliflower ...	20	28	+	16	6	8	0.14
Celery stalks bleached	0	trace		0.75	15	9	0.17
,, ,, green	14						
,, leaves ...	1,700						
Cucumber ...	0	0.25	+	2	6	7	0.08
Dandelion leaves	5,000			7	24	10	0.87
Dock leaves ...	7,000						
Endive	3,000			5	12	19	0.8
Garlic, fresh ...				7			
,, stored ...				1			
Horseradish ...				28			
Lettuce, green ...	1,400	22	+	1.5	7	8	0.2
,, bleached	420	16					
Mint	850			17			
Mustard and Cress	+	1.5		22	18	18	1.2
Olive oil, green ...	85						
,, ,, yellow ...	0						
Parsley	896						
Peas, green, fresh boiled	200	28		5	3	23	0.3
,, dried, sprouted and boiled		5		10			
Potatoes, boiled, ...	20	14		3	1.2	8.2	0.13
Radish	0	18		4	12	7	0.53
Spring onion ...	0	11	+	4	38	7	0.35
Tomatoes	650	11	+	6	4	6	0.11
Watercress ...							

Note—By using lemon juice instead of vinegar in mint sauce and in salad dressing the vitamin value is improved. Boiled sprouted dried peas can be included in winter salads.

Chart 1

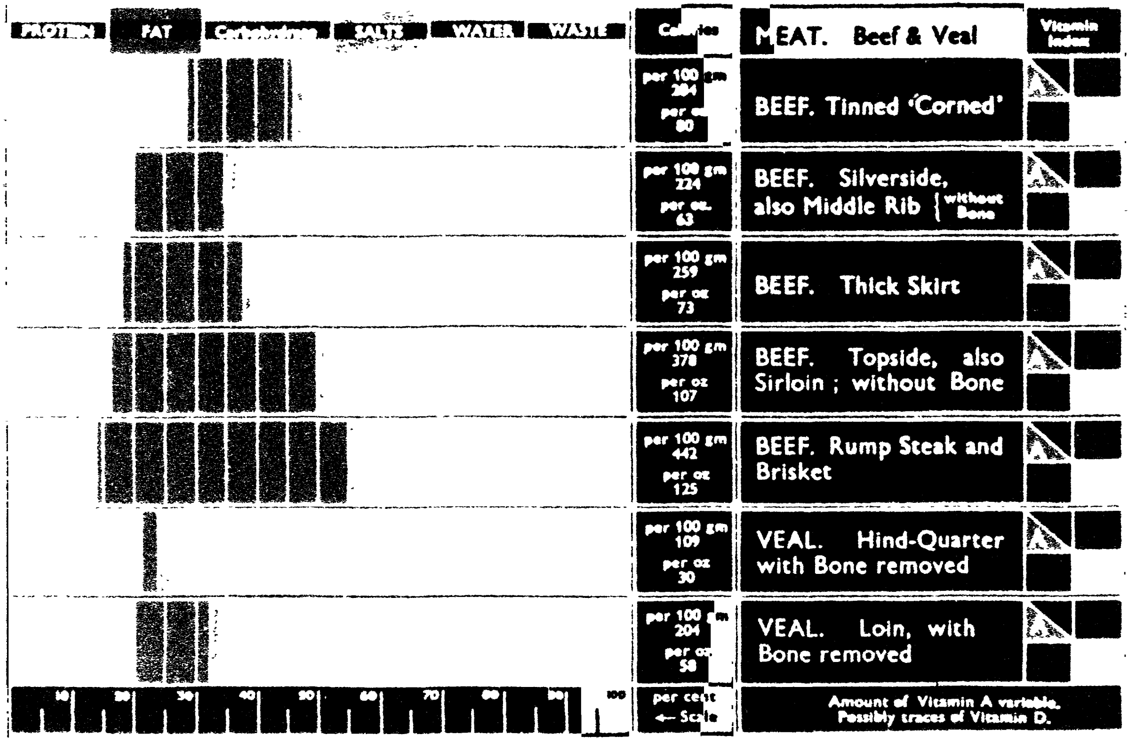


Chart 1

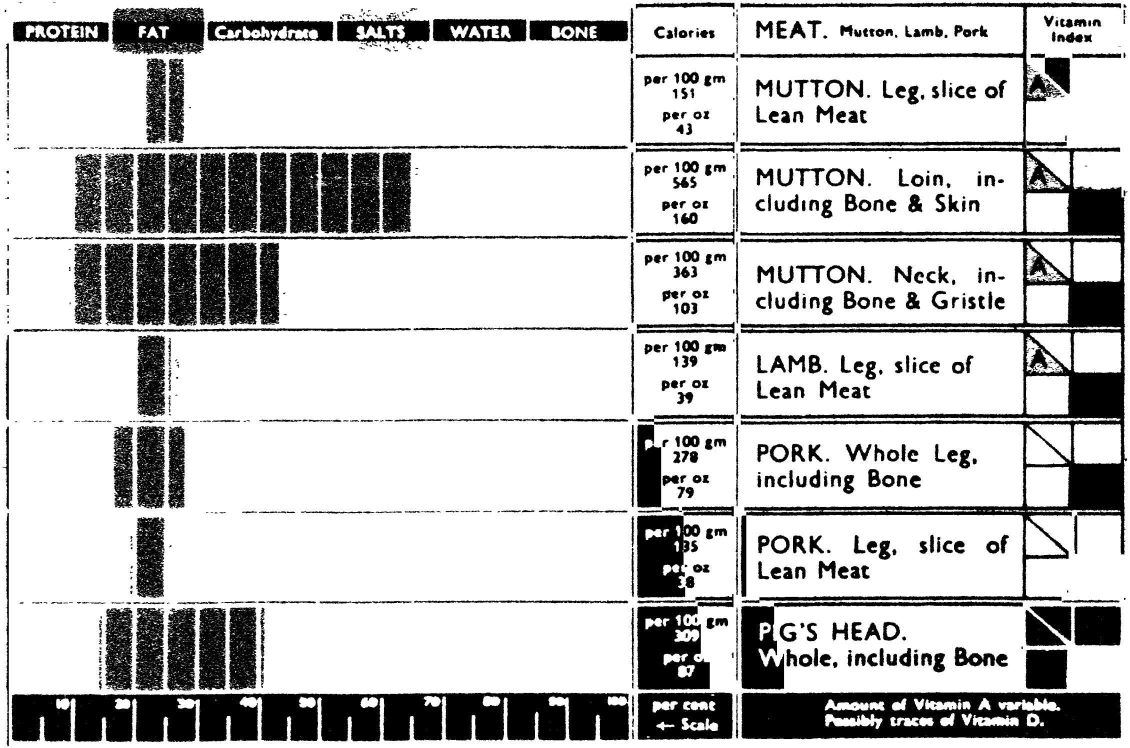
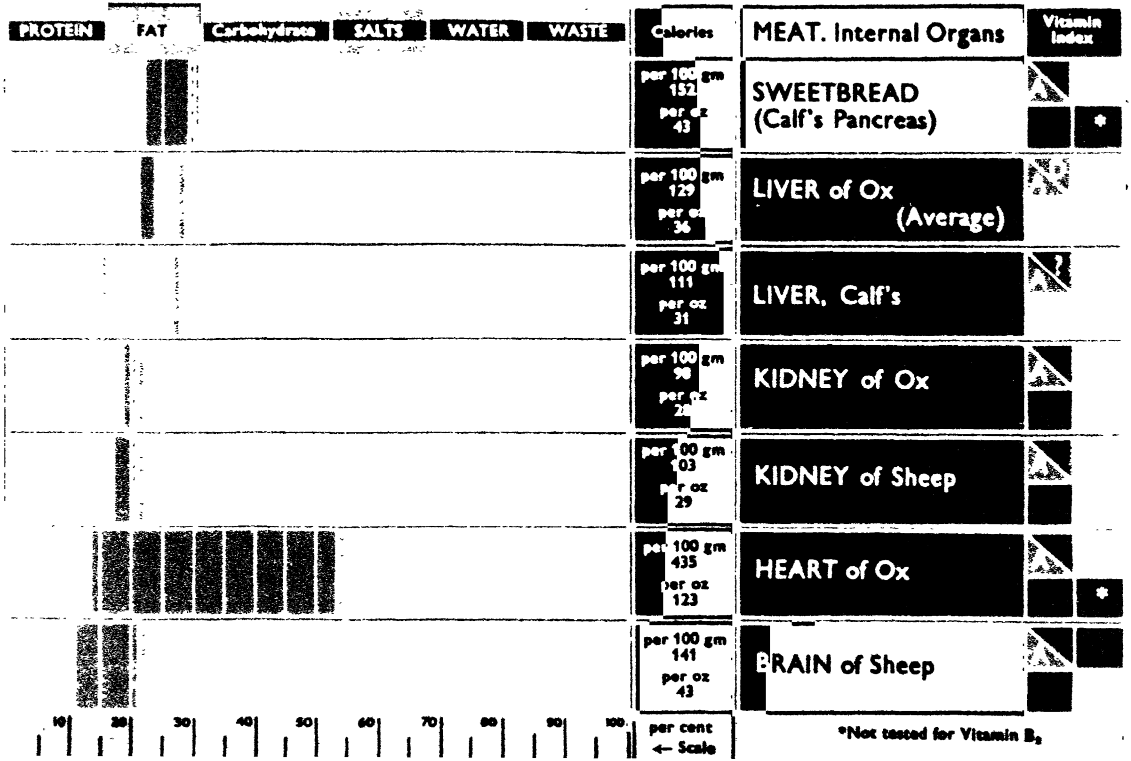

PROTEIN
FAT
Carbohydrate
SALTS
WATER
BONE
Calories
MEAT. Mutton, Lamb, Pork
Vitamin Index
per 100 gm 151 per oz 43
MUTTON. Leg, slice of Lean Meat
per 100 gm 565 per oz 160
MUTTON. Loin, including Bone & Skin
per 100 gm 363 per oz 103
MUTTON. Neck, including Bone & Gristle
per 100 gm 139 per oz 39
LAMB. Leg, slice of Lean Meat
per 100 gm 278 per oz 79
PORK. Whole Leg, including Bone
per 100 gm 135 per oz 38
PORK. Leg, slice of Lean Meat
per 100 gm 309 per oz 87
PIG'S HEAD. Whole, including Bone
A
10
20
30
40
50
60
70
80
90
100
per cent ← Scale
Amount of Vitamin A variable. Possibly traces of Vitamin D.

Chart 2

Chart 3



*Not tested for Vitamin B_2

Chart 4

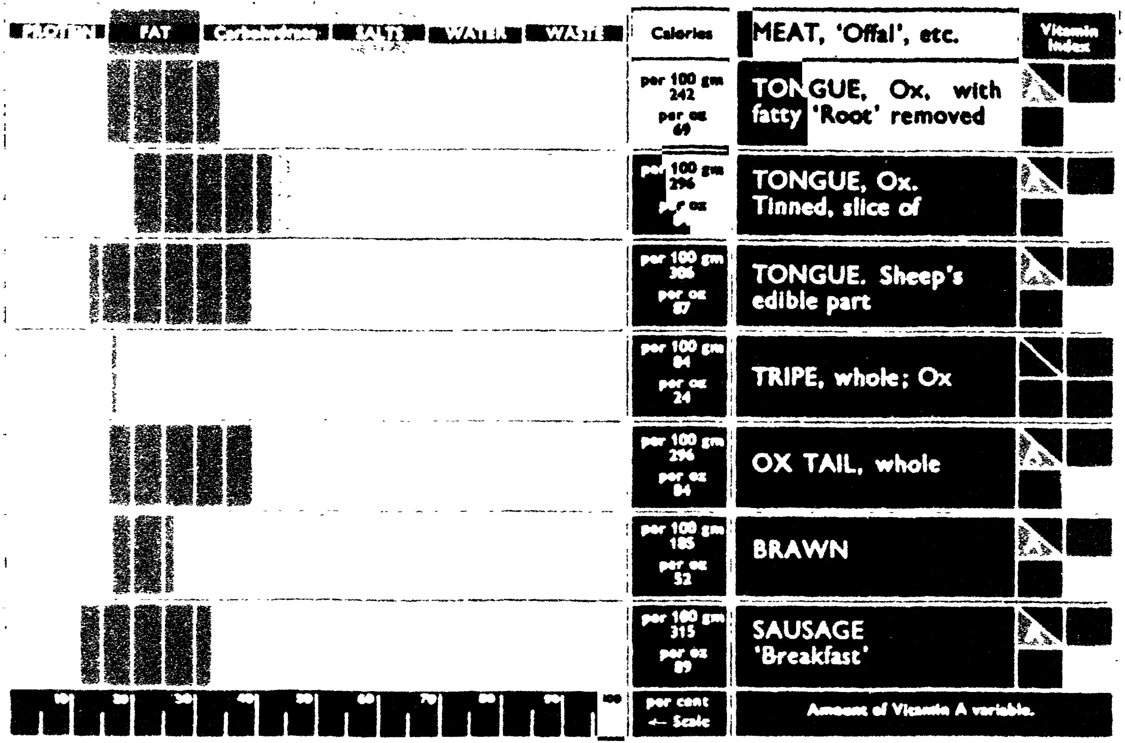

PROTEIN
FAT
Carbohydrates
SALTS
WATER
WASTE
Calories
MEAT, 'Offal', etc.
Vitamin Index
per 100 gm 242 per oz 69
TONGUE, Ox, with fatty 'Root' removed
per 100 gm 296 per oz [illegible]
TONGUE, Ox. Tinned, slice of
per 100 gm 306 per oz 87
TONGUE. Sheep's edible part
per 100 gm 84 per oz 24
TRIPE, whole; Ox
per 100 gm 296 per oz 84
OX TAIL, whole
per 100 gm 185 per oz 52
BRAWN
per 100 gm 315 per oz 89
SAUSAGE 'Breakfast'
10
20
30
40
50
60
70
80
90
100
per cent ← Scale
Amount of Vitamin A variable.

Chart 5

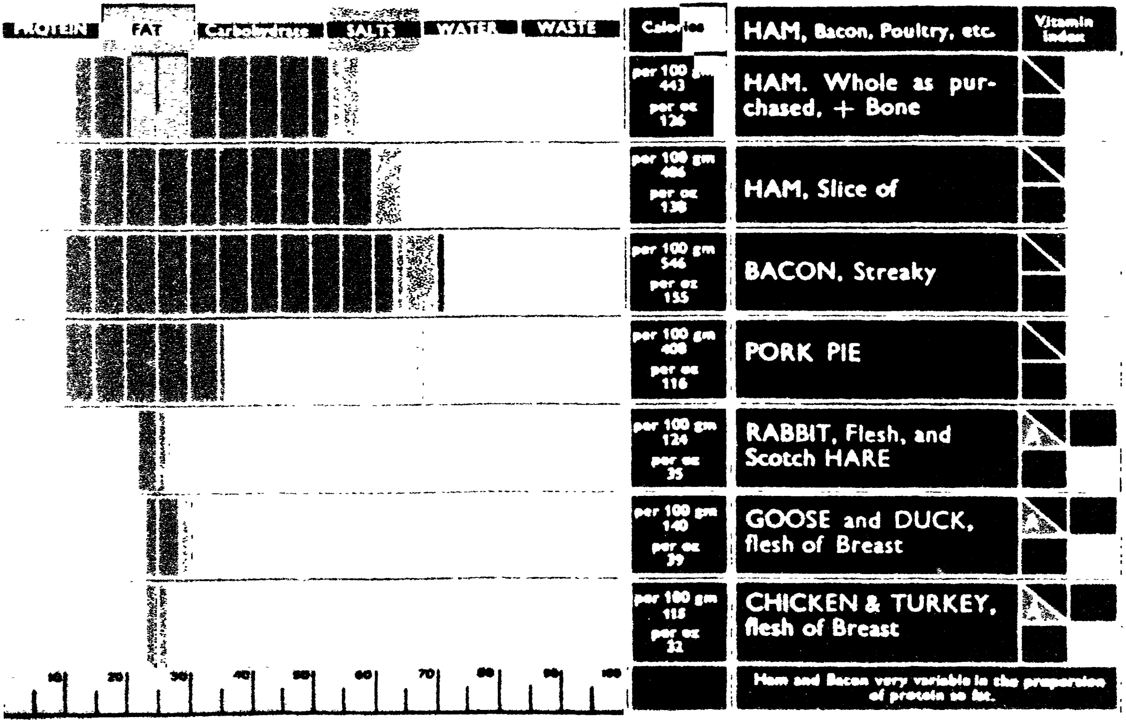


Chart 5

Chart 6

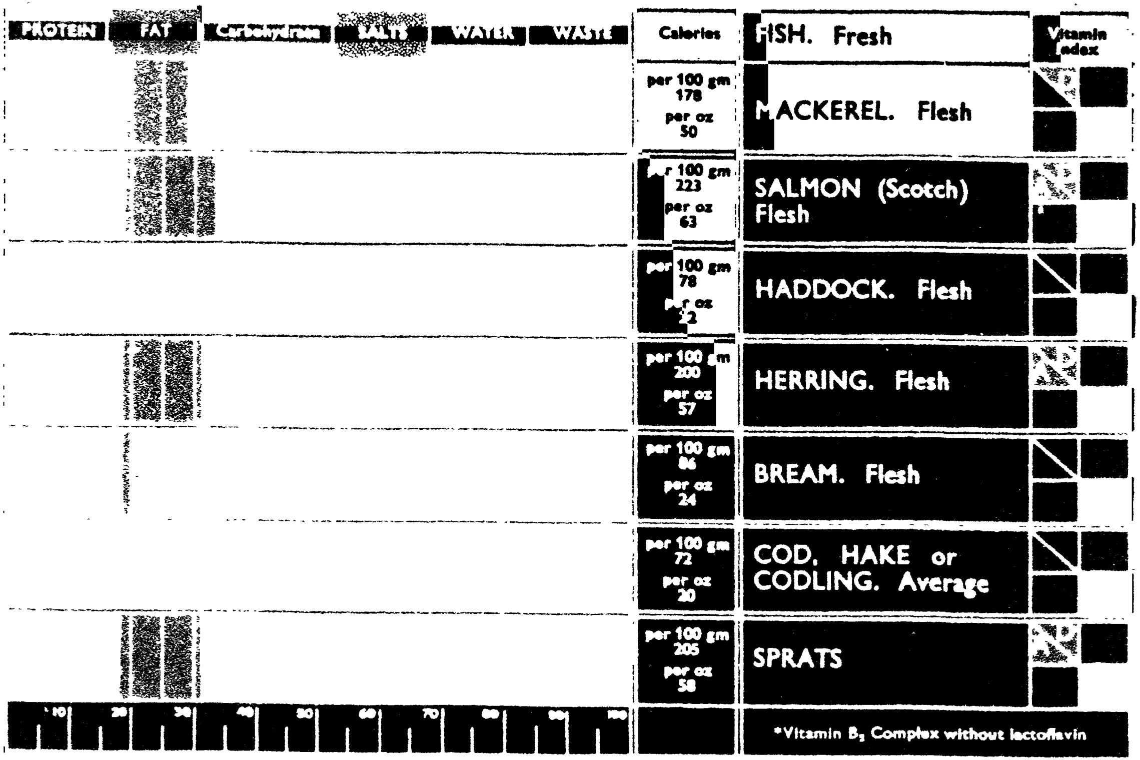
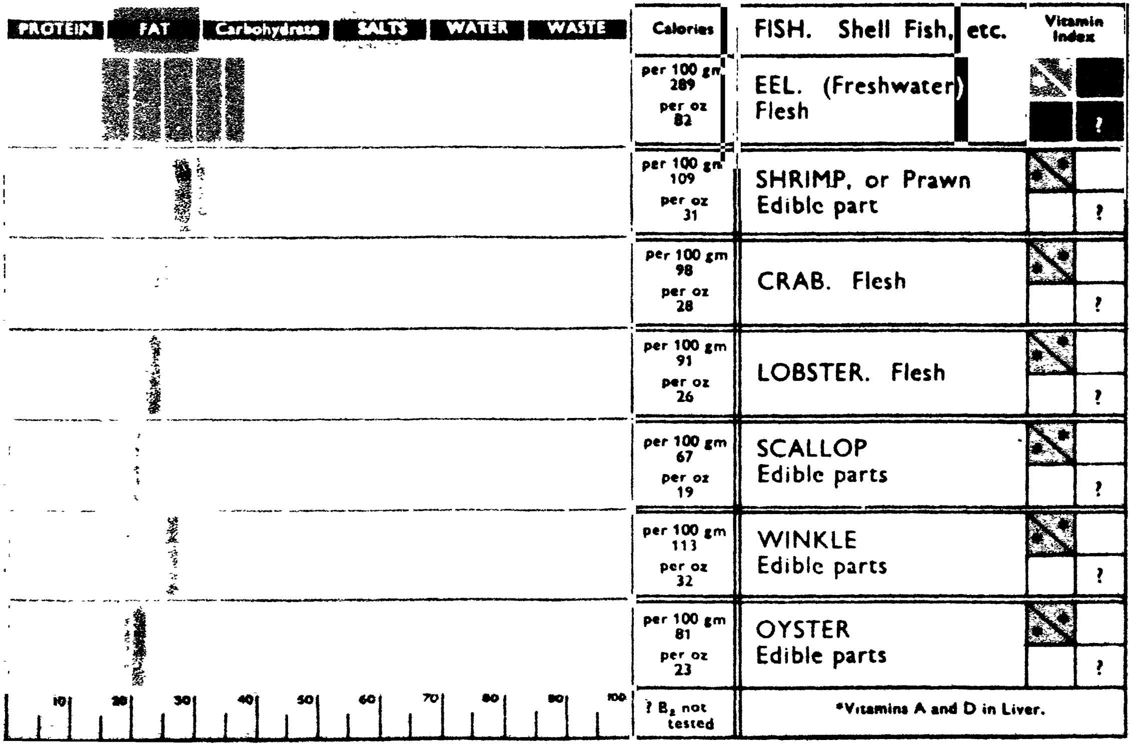

PROTEIN
FAT
Carbohydrate
SALTS
WATER
WASTE
Calories
FISH. Fresh
Vitamin Index
per 100 gm 178
per oz 50
MACKEREL. Flesh
per 100 gm 223
per oz 63
SALMON (Scotch) Flesh
per 100 gm 78
per oz 22
HADDOCK. Flesh
per 100 gm 200
per oz 57
HERRING. Flesh
per 100 gm 86
per oz 24
BREAM. Flesh
per 100 gm 72
per oz 20
COD. HAKE or CODLING. Average
per 100 gm 205
per oz 58
SPRATS
10
20
30
40
50
60
70
80
90
100
*Vitamin B$_2$ Complex without lactoflavin

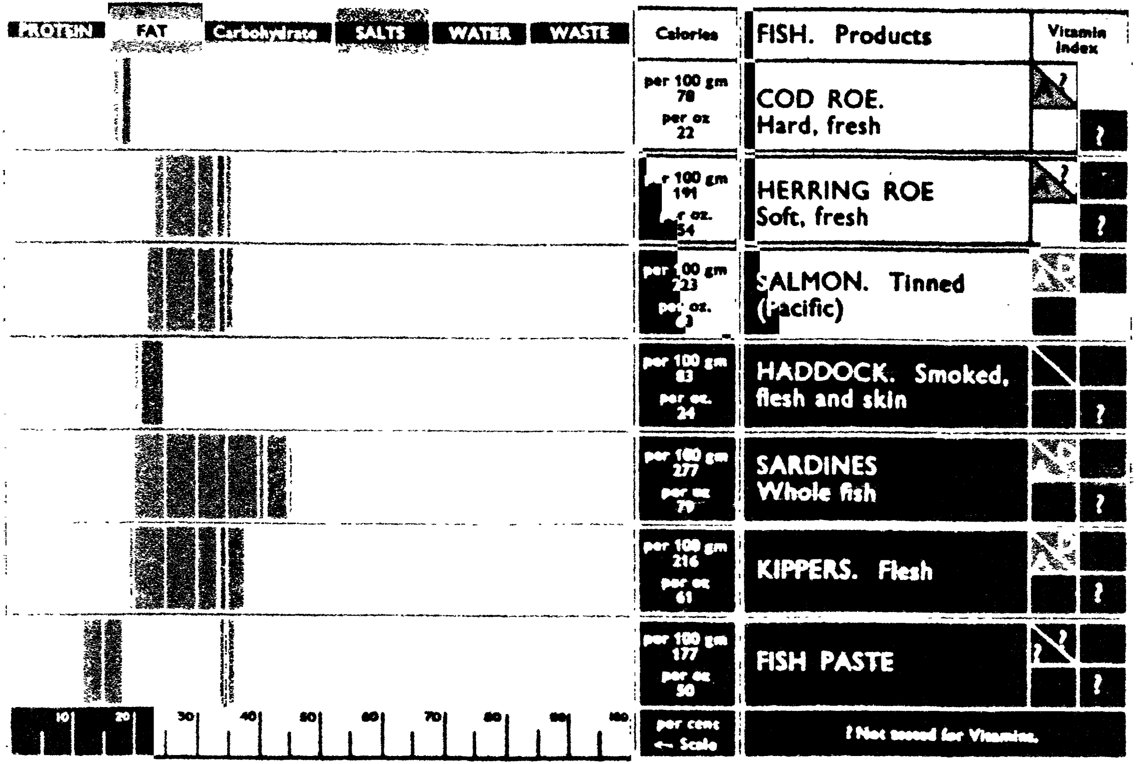
Chart 7



Calories	FISH. Shell Fish, etc.	Vitamin Index
per 100 gm 289 per oz 82	EEL. (Freshwater) Flesh	?
per 100 gm 109 per oz 31	SHRIMP, or Prawn Edible part	?
per 100 gm 98 per oz 28	CRAB. Flesh	?
per 100 gm 91 per oz 26	LOBSTER. Flesh	?
per 100 gm 67 per oz 19	SCALLOP Edible parts	?
per 100 gm 113 per oz 32	WINKLE Edible parts	?
per 100 gm 81 per oz 23	OYSTER Edible parts	?
? B_2 not tested	*Vitamins A and D in Liver.	

Chart 7

Chart 8



Calories	FISH. Products	Vitamin Index
per 100 gm 78 per oz 22	COD ROE. Hard, fresh	? ?
per 100 gm 191 per oz. 54	HERRING ROE Soft, fresh	? ?
per 100 gm 223 per oz. 63	SALMON. Tinned (Pacific)	
per 100 gm 83 per oz. 24	HADDOCK. Smoked, flesh and skin	?
per 100 gm 277 per oz 79	SARDINES Whole fish	?
per 100 gm 216 per oz 61	KIPPERS. Flesh	?
per 100 gm 177 per oz 50	FISH PASTE	? ? ?
per cent ← Scale	? Not tested for Vitamins.	

Chart 9

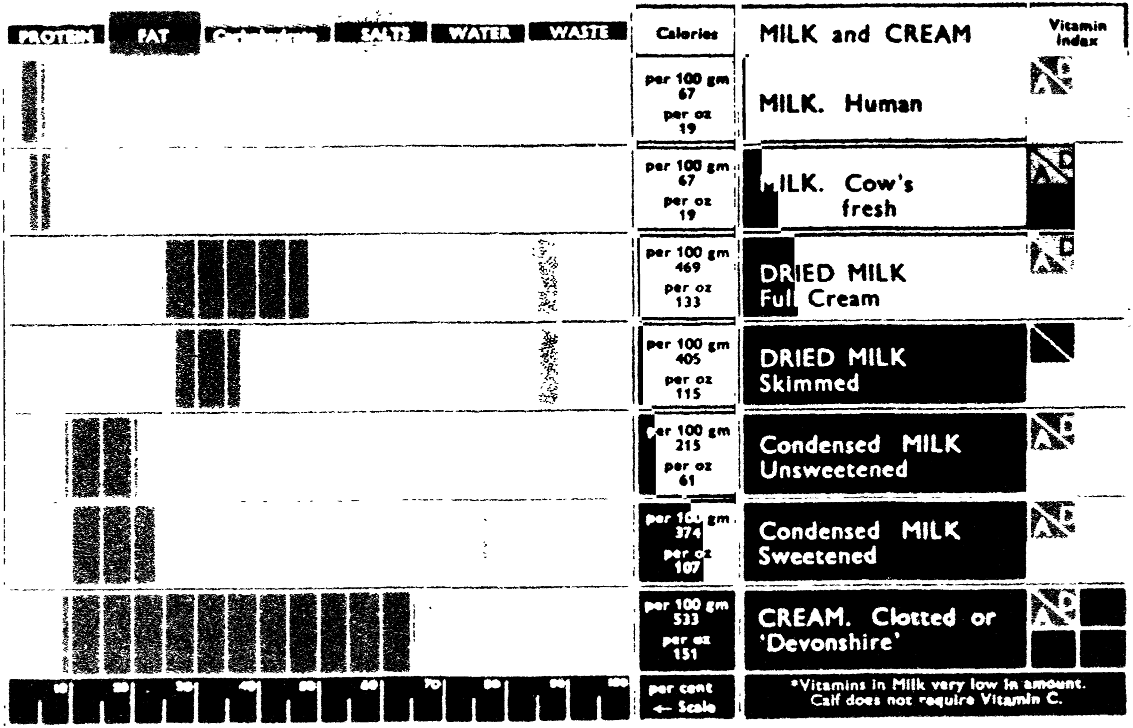
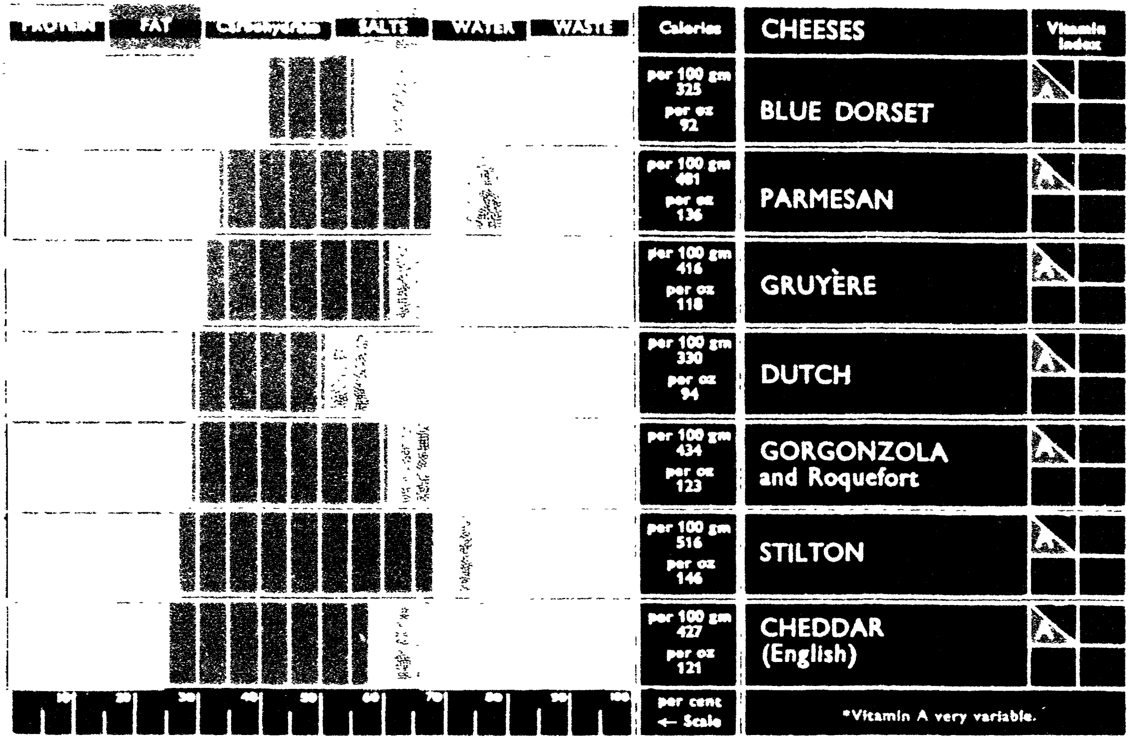


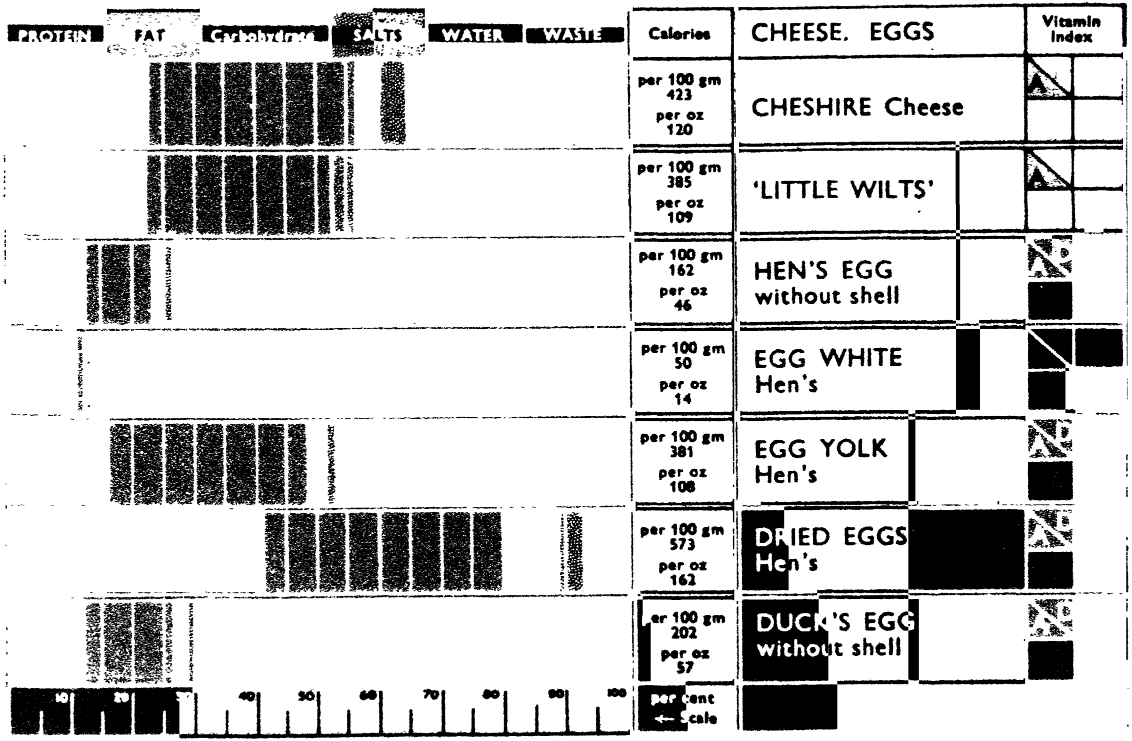
Chart 9

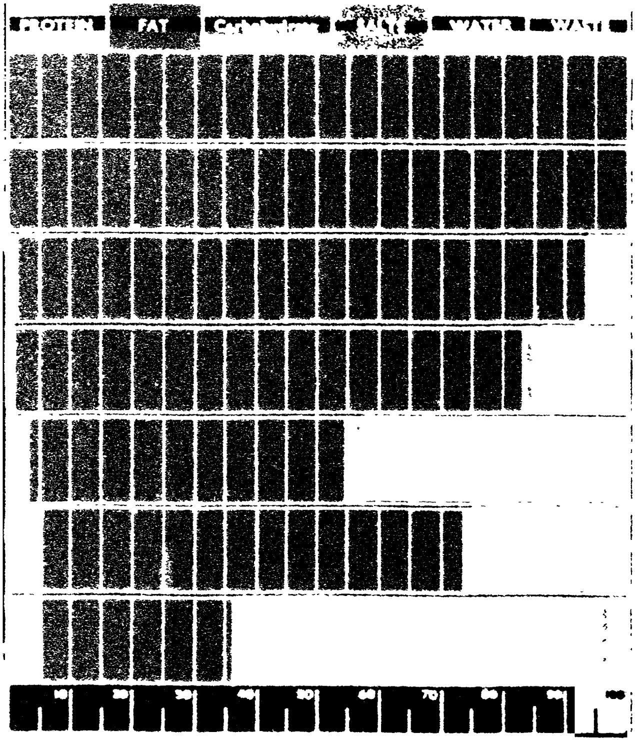
Chart 10



*Vitamin A very variable.

Chart 11


PROTEIN
FAT
Carbohydrate
SALTS
WATER
WASTE
Calories
CHEESE. EGGS
Vitamin Index
per 100 gm 423 per oz 120
CHESHIRE Cheese
per 100 gm 385 per oz 109
'LITTLE WILTS'
per 100 gm 162 per oz 46
HEN'S EGG without shell
per 100 gm 50 per oz 14
EGG WHITE Hen's
per 100 gm 381 per oz 108
EGG YOLK Hen's
per 100 gm 573 per oz 162
DRIED EGGS Hen's
per 100 gm 202 per oz 57
DUCK'S EGG without shell
10
20
30
40
50
60
70
80
90
100
per cent ← scale



Calories	FATS, OILS	Vitamin Index
per 100 gm 930 per oz 264	DRIPPING† FISH LIVER OIL*	A D
per 100 gm 930 per oz 264	LARD, OLIVE OIL, NUT BUTTER	
per 100 gm 873 per oz 247	SUET, Beef†	A D
per 100 gm 772 per oz 219	BUTTER, average Margarine (variable)	A D
per 100 gm 508 per oz 144	CREAM, Dairy	A D
per 100 gm 663 per oz 188	BONE, MARROW Calf's	A D ?
per 100 gm 554 per oz 157	CHOCOLATE (average)	
? not tested	*Very rich in Vitamin D. †Vitamins very low.	

Chart 13

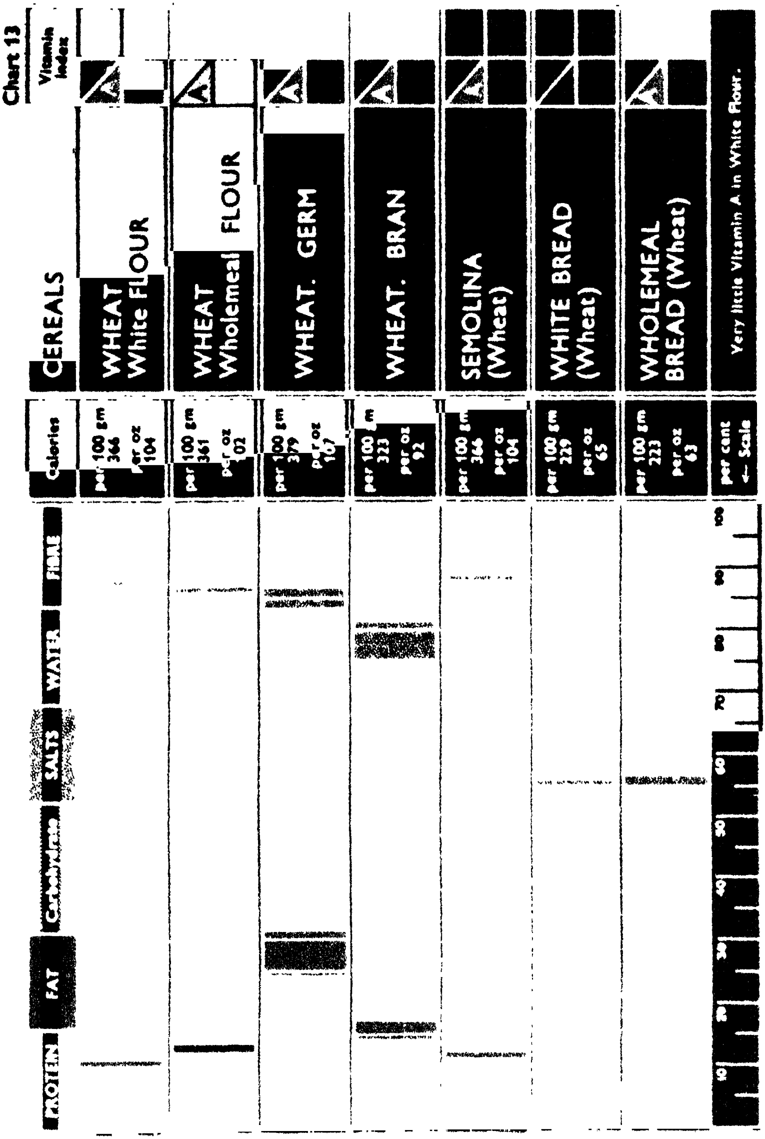
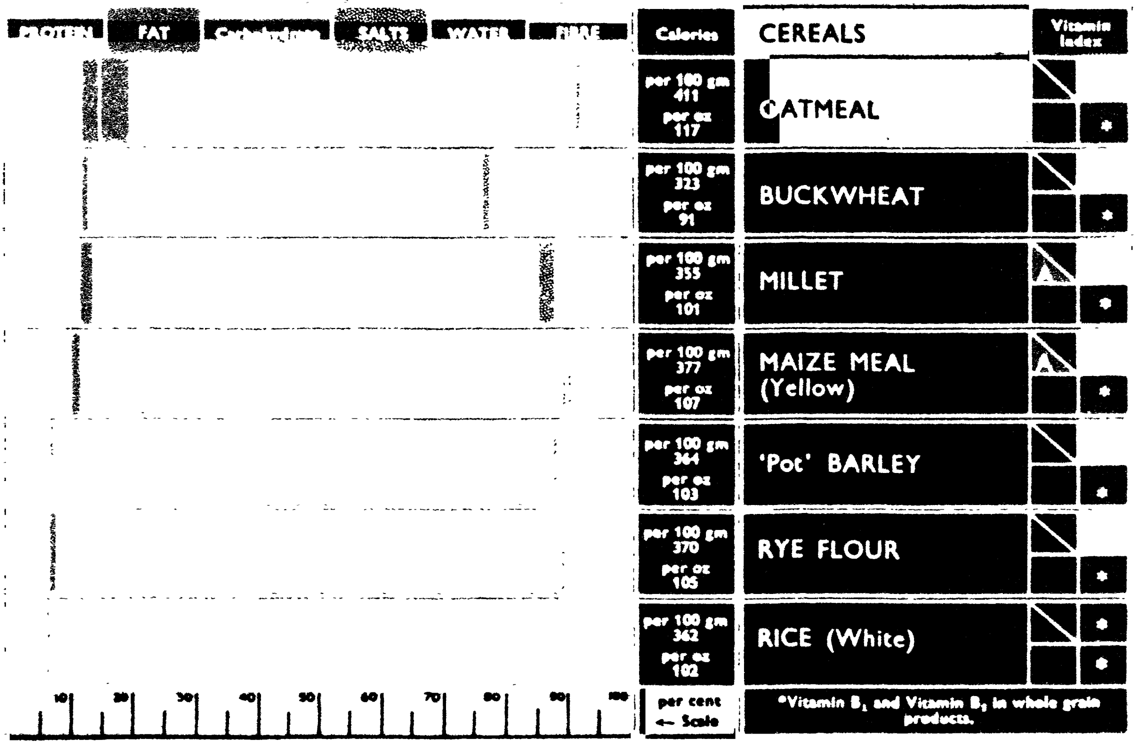


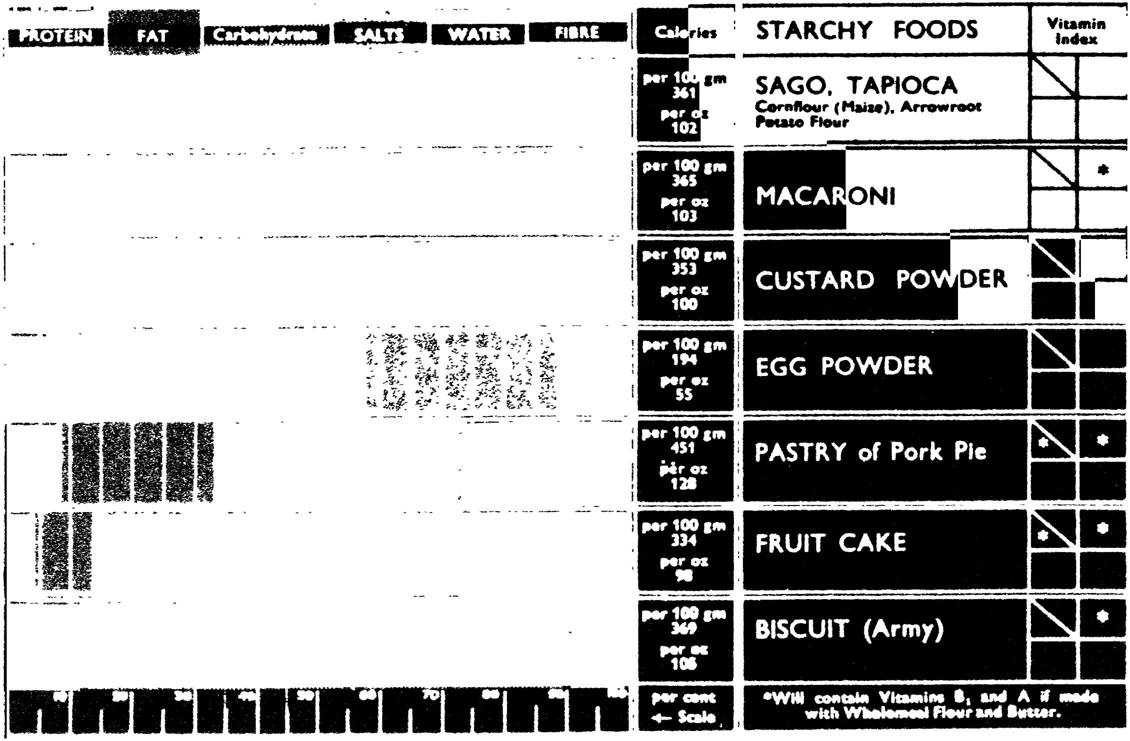
Chart 13
Vitamin index
CEREALS
Calories
WHEAT White FLOUR
per 100 gm 364
per oz 104
WHEAT Wholemeal FLOUR
per 100 gm 361
per oz 102
WHEAT. GERM
per 100 gm 379
per oz 107
WHEAT. BRAN
per 100 gm 323
per oz 92
SEMOLINA (Wheat)
per 100 gm 364
per oz 104
WHITE BREAD (Wheat)
per 100 gm 229
per oz 65
WHOLEMEAL BREAD (Wheat)
per 100 gm 223
per oz 63
Very little Vitamin A in White Flour.
per cent
← Scale
PROTEIN
FAT
Carbohydrates
SALTS
WATER
FIBRE
10
20
30
40
50
60
70
80
90
100

Chart 14



*Vitamin B_1 and Vitamin B_2 in whole grain products.

Chart 15



*Will contain Vitamins B_1 and A if made with Wholemeal Flour and Butter.

Chart 15

Chart 16

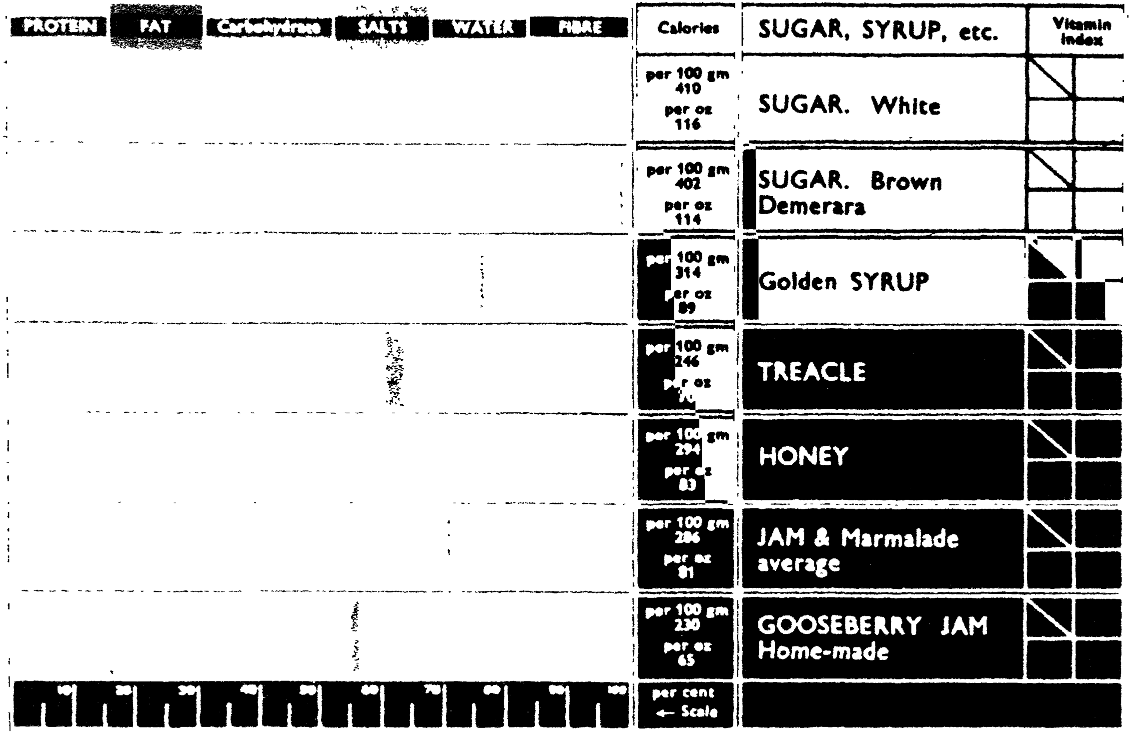


Chart 16

Chart 17

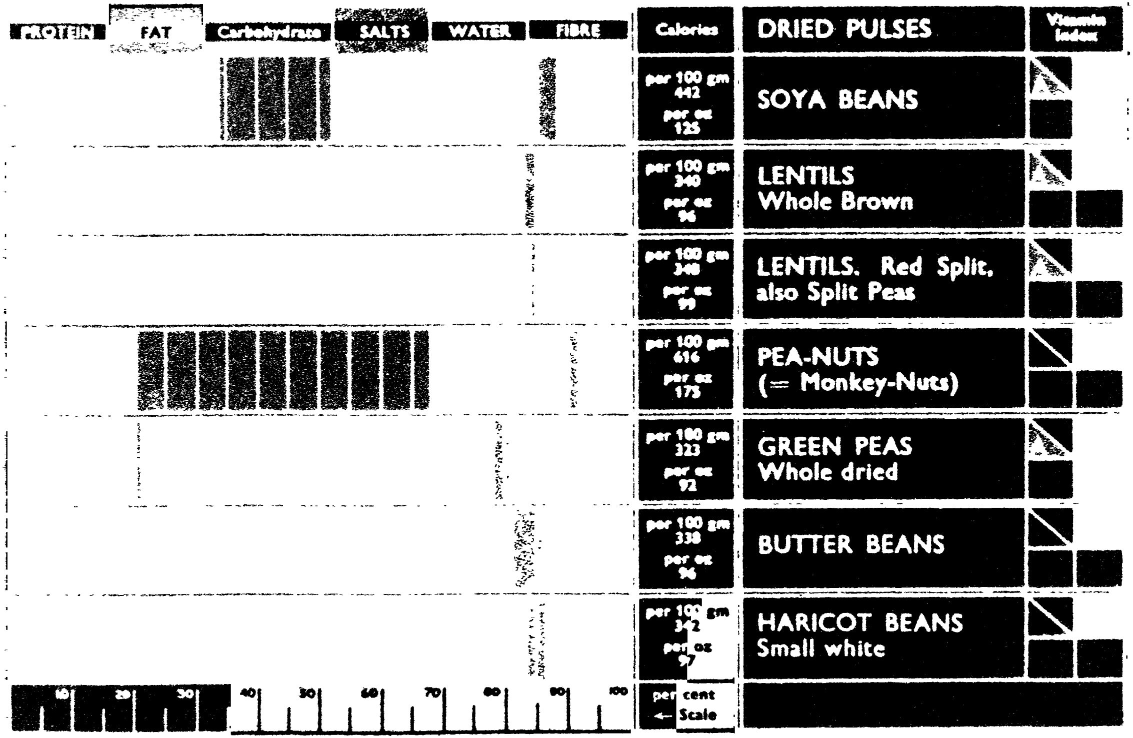
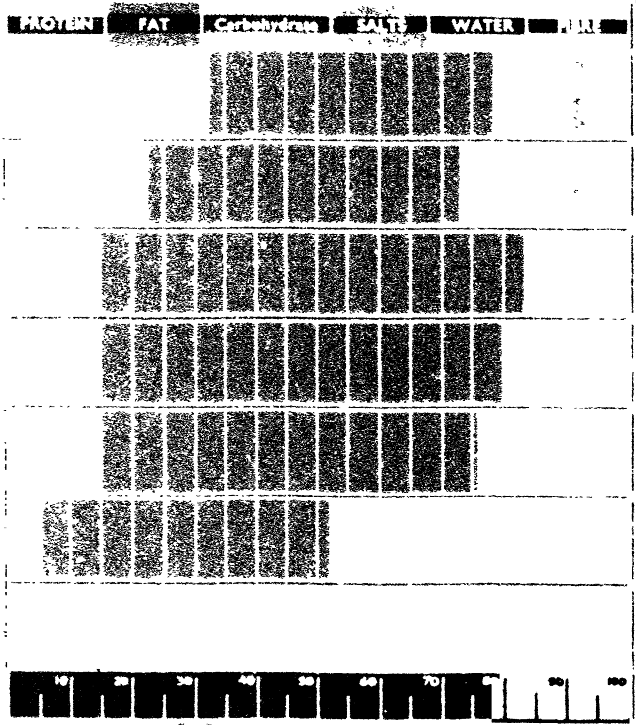


Chart 17



Calories	NUTS. Shelled	Vitamin Index
per 100 gm 617 per oz 175	PINE KERNEL	?
per 100 gm 639 per oz 181	ALMOND. Jordan	?
per 100 gm 742 per oz 210	BRAZIL NUT	?
per 100 gm 731 per oz 207	WALNUT. Dried Kernels	?
per 100 gm 700 per oz 199	HAZEL	?
per 100 gm 500 per oz 142	COCO-NUT. Flesh	?
per 100 gm 228 per oz 64	CHESTNUT	?
per cent ← Scale	For Pea-nut. See Chart 17. ? Not tested, but B_2 likely to be present.	

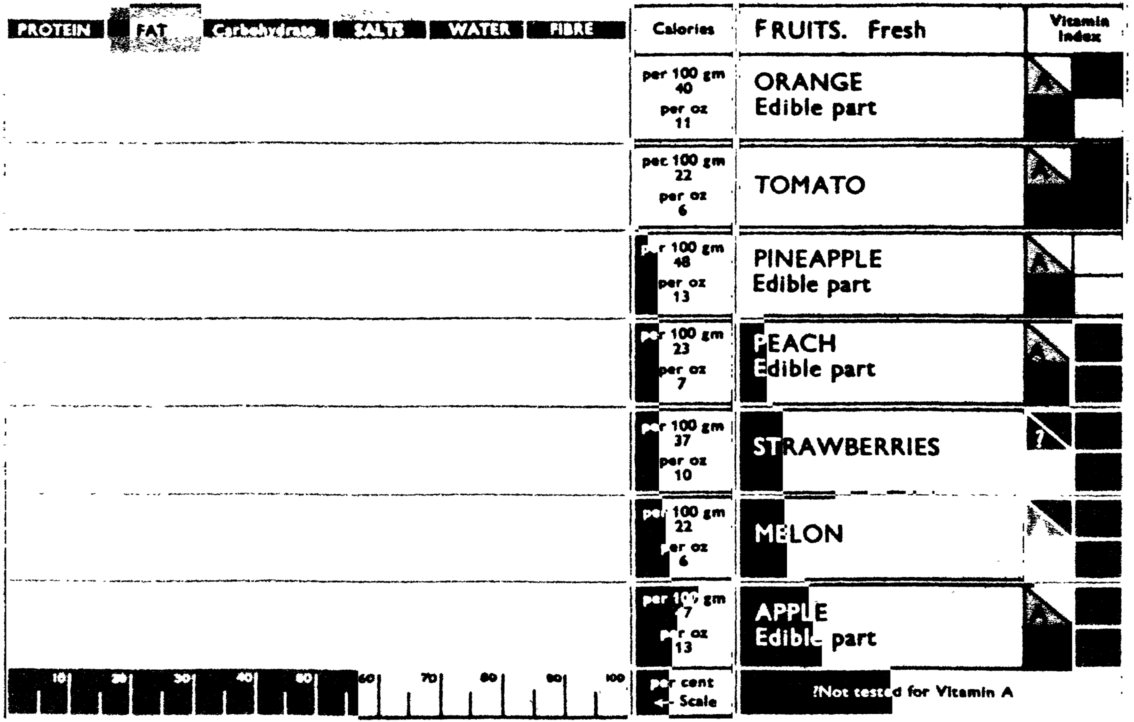

PROTEIN
FAT
Carbohydrate
SALTS
WATER
FIBRE
Calories
FRUITS. Fresh
Vitamin Index
per 100 gm 40 per oz 11
ORANGE Edible part
per 100 gm 22 per oz 6
TOMATO
per 100 gm 48 per oz 13
PINEAPPLE Edible part
per 100 gm 23 per oz 7
PEACH Edible part
per 100 gm 37 per oz 10
STRAWBERRIES
?
per 100 gm 22 per oz 6
MELON
per 100 gm 47 per oz 13
APPLE Edible part
10
20
30
40
50
60
70
80
90
100
per cent
← Scale
?Not tested for Vitamin A

Chart 19

Chart 20

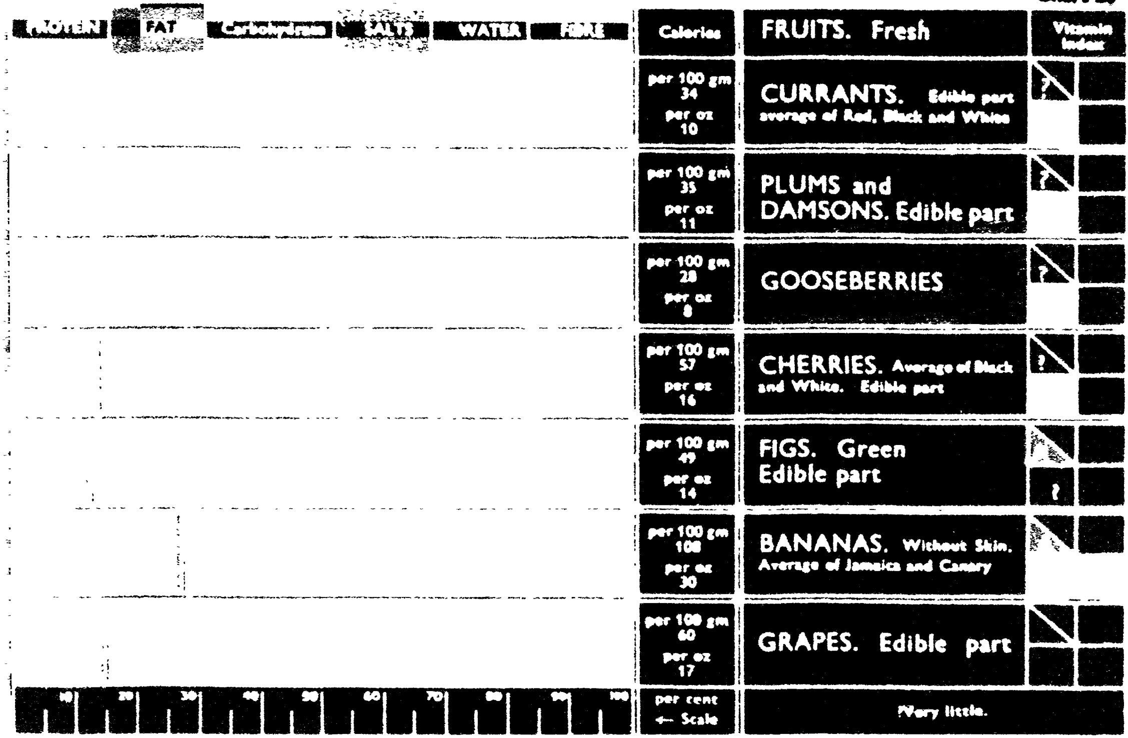
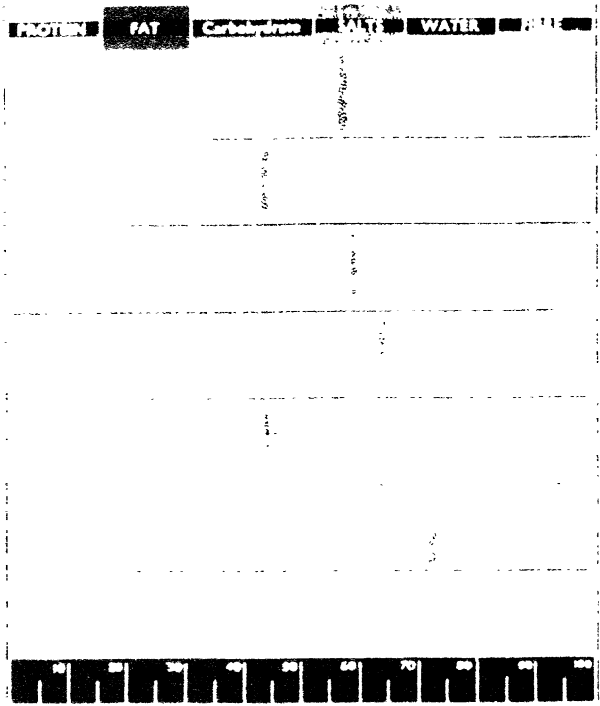
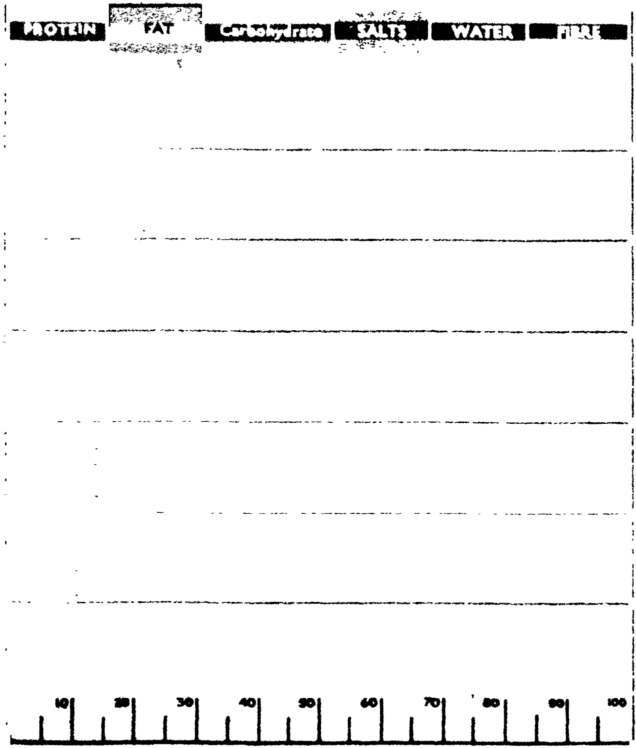


Chart 20



Calories	DRIED FRUITS	Vitamin Index
per 100 gm 229 per oz 65	APRICOTS	
per 100 gm 151 per oz 51	PRUNES Without stone	
per 100 gm 244 per oz 69	FIGS	
per 100 gm 263 per oz 74	RAISINS and SULTANAS. Average	
per 100 gm 182 per oz 52	CURRANTS	
per 100 gm 293 per oz 83	DATES. Edible part	
per 100 gm 250 per oz 71	APPLE RINGS	
per cent ← Scale		

Chart 21



Calories	VEGETABLES	Vitamin Index
per 100 gm 109 per oz 31	BROAD BEANS Without pods	?
per 100 gm 89 per oz 25	GREEN PEAS Shelled	?
per 100 gm 30 per oz 9	WHITE WAX & BUTTER BEANS	?
per 100 gm 26 per oz 7	FRENCH BEANS and Scarlet Runners	?
per 100 gm 56 per oz 16	CURLY KALE	?
per 100 gm 40 per oz 11	BRUSSELS SPROUTS	?
per 100 gm 35 per oz 10	CAULIFLOWER	?
per cent ← Scale	!Not tested	

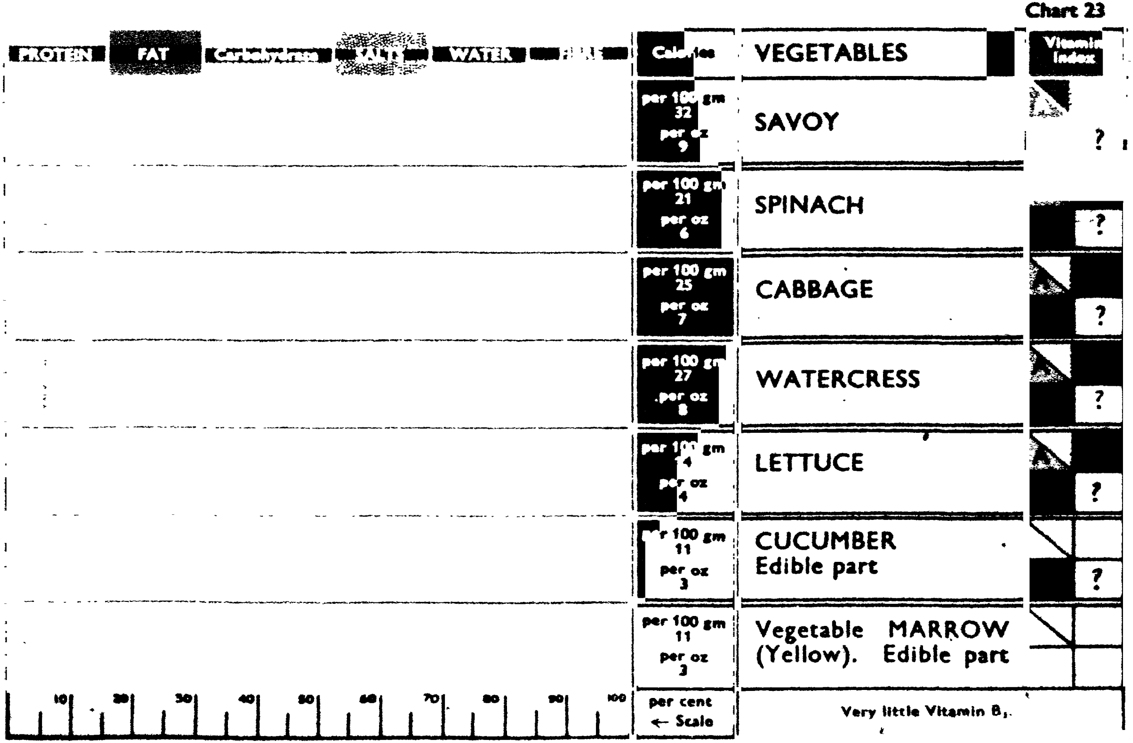
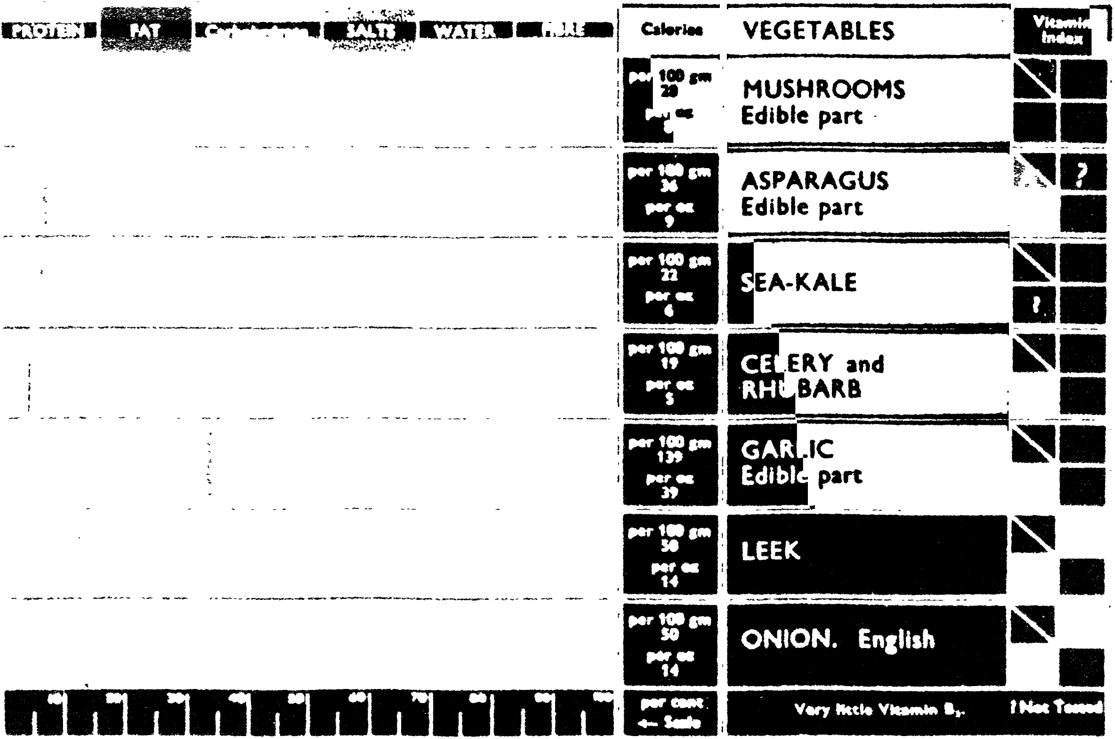


Chart 23
PROTEIN
FAT
Carbohydrate
SALTS
WATER
FIBRE
Calories
VEGETABLES
Vitamin Index
per 100 gm 32 per oz 9
SAVOY
?
per 100 gm 21 per oz 6
SPINACH
?
per 100 gm 25 per oz 7
CABBAGE
?
per 100 gm 27 per oz 8
WATERCRESS
?
per 100 gm 14 per oz 4
LETTUCE
?
per 100 gm 11 per oz 3
CUCUMBER Edible part
?
per 100 gm 11 per oz 3
Vegetable MARROW (Yellow). Edible part
10
20
30
40
50
60
70
80
90
100
per cent
← Scale
Very little Vitamin B₁.

Chart 24


PROTEIN
FAT
Carbohydrate
SALTS
WATER
FIBRE
Calories
VEGETABLES
Vitamin Index
per 100 gm 20 per oz
MUSHROOMS Edible part
per 100 gm 36 per oz 9
ASPARAGUS Edible part
?
per 100 gm 22 per oz 6
SEA-KALE
!
per 100 gm 19 per oz 5
CELERY and RHUBARB
per 100 gm 139 per oz 39
GARLIC Edible part
per 100 gm 50 per oz 14
LEEK
per 100 gm 50 per oz 14
ONION. English
70
per cent
← Scale
Very little Vitamin B₁.
! Not Tested

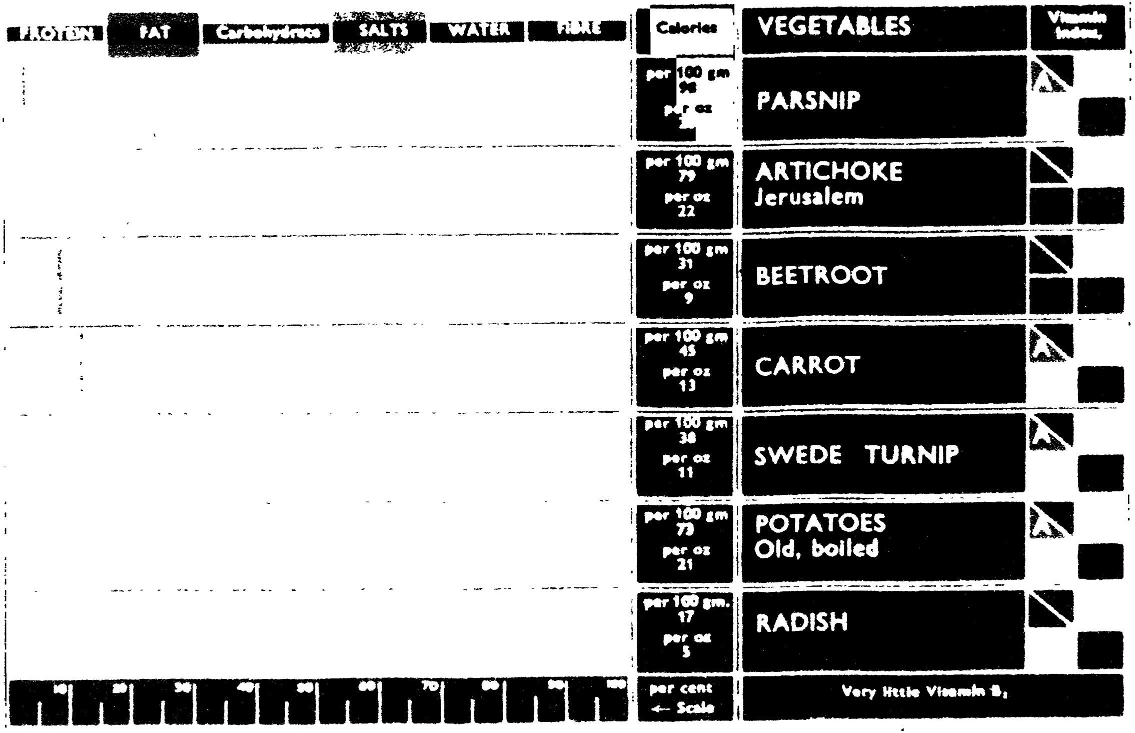
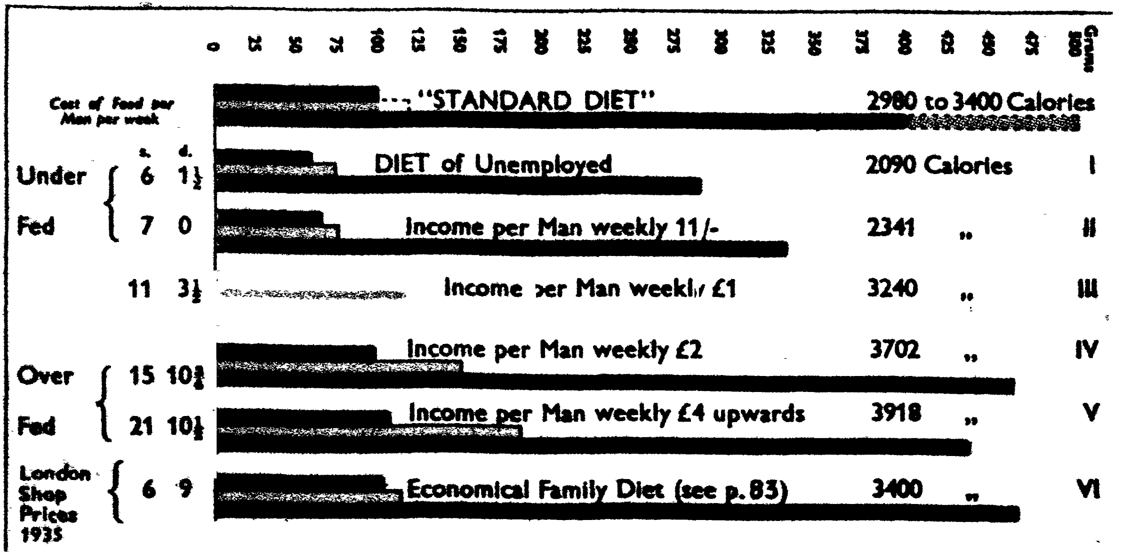

PROTEIN
FAT
Carbohydrates
SALTS
WATER
FIBRE
Calories
VEGETABLES
Vitamin Index,
per 100 gm 98 per oz [illegible]
PARSNIP
per 100 gm 79 per oz 22
ARTICHOKE Jerusalem
per 100 gm 31 per oz 9
BEETROOT
per 100 gm 45 per oz 13
CARROT
per 100 gm 38 per oz 11
SWEDE TURNIP
per 100 gm 73 per oz 21
POTATOES Old, boiled
per 100 gm. 17 per oz 5
RADISH
10
20
30
40
50
60
70
80
90
100
per cent ← Scale
Very little Vitamin B₁

Chart 25

Chart 26



Diets numbered I to V show the changes in composition and amount as the income rises. (Based on data from the Medical Research Council Report No. 151 by Carthcart and Murray. H.M.'s Stationery Office.) Compare these five diets with the Standard Diet (page 47) and with Diet VI. Diet III is unnecessarily expensive. Diet V represents gross over-nutrition. Diets I and II are well proportioned but insufficient in energy value

Chart 26

INDEX

Abortion, Sterility, 36, 37, 90, 91
Absorption, Assimilation of food, 26, 27, 48, 67, 92, 94, 96, 99
Accessory food factors, 30
Acidosis, 99
Adermin, 33, 63
Adolescents', diet of, 45, 46, 73, 77. *See* Boarding School Diets
Adult diet, 44, 50–52, 58–60, 72. *See also* Man's, Woman's, Mother's diet
Age and food requirements, 41, 45, 46, 50
Ageing of foodstuffs, 64
Agriculture, farming, 40, 106–116, 126–128
Albumin, 25
Alcohol, 91, 92
Alkaline salts, 59
Allotments, 81, 127
Almond, 62, 97. Table 10
Amino acids, 23–25
Anaemia, 15, 17, 29, 39, 52, 88
Analyses of foodstuffs, 22, 23, 43, 86. Table 13
Aneurin, 33. *See* Vitamin B_1
Animal fats and oils, 26, 34, 35. *See* Butter, Fish oils, Lard, *etc.*
Antiberiberi substance, Antineuritic substance, 33. *See* Vitamin B_1
Antipellagra substance (vitamin B_7), 33. *See* Nicotinic acid
Antirachitic vitamin, 34. *See* Vitamin D, 34
Antiscorbutics, 64, 105
Appetite, 35, 41, 45, 46, 52, 75
Apple. Tables 7, 10, 11, 13
Apricot, 99. Table 9
Arctic regions, 44
Army recruits physical condition, 14–16
Arrowroot, 26
Artificial foodstuffs, 89, 98
Artificial manures, 124, 128
Ascorbic acid, 33, 64–67, 87. *See* Vitamin C
Ash, 28, 126. *See* Mineral salts
Asparagus, 66, 104. Table 9, 11
Asthma, 25
Athletes, 99
Auto-intoxication, 48, 99
Aubergine, 66
Average diet, 14
Axerophthol, 32. *See* Vitamin A

Babies. *See* Infants' diet.
Bacon, 62, 82, 86, 89, 93, 97. Table 10
Balanced diet, 56, 58, 90
Banana, 49, 59, 62
Barley, 54, 62, 112
Basal metabolism, 44, 46
Beans, 25, 58, 59, 62, 66, 89, 96, 97, 105, 112
Beef, 62, 64, 93
Beer, 96
Beetroot, 62
Beet sugar, 106, 107, 111
Bemax, 59, 62, 63. Table 10. *See* Wheat germ
Beriberi, 32, 35, 60, 61
Berries, 54, 65, 102. Table 11
Biological value of proteins, 23, 51. Table 2
Birds, 24, 89
Blackcurrants, 59, 66, 105. Table 11
Bleached vegetables, 58, 104
Blood, 17, 24, 25, 27, 28, 35, 37, 65, 102, 103
Boarding school food, 45, 51, 52, 73–80
Body-building material, 18, 20. *See* Protein
Body-oil of fishes, 57, 94
Body temperature, warmth, 20, 41
Body-weight, 39, 41, 42, 58, 60, 66, 91
Boiling of foods, 57, 62, 66, 67, 103, 104
Boils, 37
Bone marrow, 32, 57, 59, 97
Bones, 15, 28, 29, 36, 54, 55, 67, 94

Bowel, 27
Bran, 32, 49, 60, 63, 95–97. Table 10
Brazil nuts, 97
Bread, 49, 61–63, 86, 89, 100, 112. Table 7. *See* White and Wholemeal bread
Breakfast cereals, 49, 62, 63. *See* Oatmeal, Porridge
Breakfasts for school children, 88. *See* Oslo breakfast
Breast feeding, 35. *See* Lactation
Breeding of animals, 90
Brewers' yeast, 100
Brisling, 94
Broad beans, 66
Broccoli, 66. Table 11
Broncho-pneumonia, 35
Brown bread, 80. *See* Wholemeal bread
Brussels sprouts, 52, 62, 66, 105. Table 11
Buckwheat, 62, 112. Table 10
Budgets, weekly food, 61, 72, 78, 83, 84
Butter, 35, 58, 59, 86, 90, 97, 110. Tables 9, 12

Cabbage, 54, 57–59, 62, 66, 101. Tables 9, 10, 11, 14
Cake, animal feeding 89
Calciferol (vitamin D), 34, 67
Calcification of bones and teeth, 34, 35, 54
Calcification of soft tissues, 68
Calcium, calcium salts, 28–30, 35, 39, 54, 55, 67, 68, 94, 100. Table 8
Calculations, dietary, 43, 45, 60, 72, 77, 78
Calf's liver, 58, 59, 66. Tables 9, 12
Calorie defined, 42
Calorie value, calculation of, 43, Table 7
Calorie requirement at different ages, Table 1.
Calorimeter, 42, 44
Calves, 65
Cancer, 14, 38, 42
Cane sugar, 99
Canned foods, 57, 59, 62, 64, 67, 82, 93, 103–105, 110. Tables 9, 10, 11, 12
Canteloupe melon, 99
Carbohydrates, 22, 43, 47–51, 60, 85, 86, 92, 97, 100. *See* Sugar *and* Starch
Carotene, 30, 35, 56, 57, 90, 121
Carrots, 32, 58, 59, 62, 67, 100, 102
Casein, 25
Caseinogen, 24
Cashew nuts, 97
Catarrh, 35
Catering, 12, 13, 42, 72
Cattle, live stock, food of, 33, 89, 91, 110, 112, 113
Cauliflower, 57, 62, 66, 67. Table 11
Celeriac, 102
Celery, 58, 101, 104
Cellulose, 26, 27
Cereals, 25, 32, 36, 49, 60, 63, 64, 95, 98, 112. Table 7. *See* Seeds *and* White *and* Wholemeal Cereals
Changing food habits, 48, 49, 70, 95, 98
Cheap vitamin diet, 58, 82. *See* Simple " Square Meals "
Cheese, 25, 49, 54, 58, 59, 62, 86, 87, 95. Table 9
Chemical Analyses of foods, 22, 43 Table 13, Coloured Charts
Chestnuts, 62, 66, 97. Tables 10, 11
Chicken, chicks, 64, 65, 89, 90, 95
Chicken's liver, 66
Child's diet, 39, 40, 45, 46, 51, 54, 55, 58–60, 66, 67, 71, 93, 96–98, 110
Chlorophyll, 29, 32, 121
Chocolate, cocoa, 97, 98
Chronic ill health, disease, 14, 15, 31, 42
Citration of milk, 64
Citrus fruits, 49, 106, 116. *See* Grape fruit, Lemon, Orange
Civilization, effect of, 14, 36, 81
Climate and diet, 41, 44
Clinical tests for vitamin underfeeding, 40
Clotting, coagulation, 25, 28
Cod, 62, 81
Cod liver oil, 34, 35, 57, 68, 88–90, 96. Tables 9, 12

Coefficients of energy requirements, 45, 46
Cold storage, 57, 59
Colitis, 38
Coloured charts, explanation of, 22, 25, 26, 43, 85, 86, 93–100
Coma, diabetic, 99
Combustion, burning of food in the body, 22, 26, 43, 48
Commercial processes and foods, 57, 64, 95, 96, 99, 110
Comparative energy values of foods, Tables 5, 6, 7
Comparative vitamin values of foods. Tables 9–14
Complacency, dangers of, 13, 19
Complete diet, 21–31, 85, 86. *See* Square Meals *and* Frontispiece
Composition of diet, 47–49, 70
Composition of common foodstuffs, Table 7
Concentrates of vitamins, 68
Condensed milk, 62, 82, 95, 105, 110
Conjunctivitis, 35
Conservation of vitamins, 56–68
Continental cookery, 103, 104
Convulsions, 34, 35
Cooking, 53, 54, 59, 62, 64, 66, 67, 96, 103–105
Copper, 29, 54
Corned beef, 93, 95
Cornflour, 26, 60. *See* Maize
Corn syrup, 98
Cost, price, of food, 12, 40, 47, 63, 81, 98, 100, 107, 109, 110, 116–120. Tables 3, 4, 5. *See* Economical diets
Cows, calves, cattle, food of, 33, 58, 89, 90
Cream, 35, 90
Cress 62, 71, 101. Table 11
Crystalline preparations of vitamins, 33
Cucumber. Table 11
Culinary skill, 103
Curd of milk, 94, 95
Cycle of life, 111, 121–129

Dandelion leaves, 57, 101
Daily quantity of minerals, 54, 55
Daily quantity of protein, 50
Daily quantity of vitamins, 58–68
Dairy products, 49, 56, 90, 94, 95, 116. Table 7
Dates dried, 59, 99
Day's food requirement, 44
Decayed teeth, dental caries, 37, 39, 81
Deficiency diseases, 13, 31, 32, 34–38
Destruction, loss of vitamins, 59, 63, 64, 66, 67, 103, 104
Detection of vitamin underfeeding, 38–40
Devonshire cream, 95
Diabetes, 14, 36, 42, 46, 92, 98
Diarrhoea, 36, 39
Diet, a complete, 21–31
Digestion, digestibility, 22, 24, 25 27, 28, 38, 48, 92, 96, 97, 99, 102
Digestive troubles, dyspepsia, 15, 35–37
Disease in animals, cost of, 89
Diseases of civilization, 11, 13, 36.
Distributing trade, 110, 117, 118
Dock leaves, 102, 103
"Doctors Cookery Book," 61
Dogfish, 57
Dogs, 89
Dried beans, lentils, peas, 62, 96, 97, 101
Dried foodstuffs, 57, 62, 64, 67
Dried fruits and vegetables, 58, 59, 62, 99, 100. Table 9
Dried milk, 95, 110
Dripping, 93
Dry foods, 86
Drugs, 18

Ear, infections of, 35
Eels, 57, 94
Effects of vitamin deficiencies, 34–40
Eggs, 24, 35, 36, 53, 58, 62, 67, 87, 90, 95. Tables 7, 9
Egg laying, 90
Elementary school children, meals for, 88, 89
Endocrine glands, 38
Endosperm, 95, 96
Energy requirement, expenditure, metabolism, output, 26, 41–46, 49, 60, 73. Table 1
Energy value of foods, 21, 25, 27 38, 97, 121. Tables 5, 6, 7, *See* Calorie value, Fuel value

English cookery, defence of, 102
Ergosterol, 34, 67, 100
Errors in diet, 12–14, 16, 18
Evaluation of diets, 70
Excess of carbohydrate (starch, sugar), 26, 60, 70, 87, 106
Excess of fats, 25
Excess of vitamin D, 68
Excretion, 22, 23, 67, 68
Exercise, 44, 89
Explanation of frontispiece, 85–87
Explanation of coloured charts, 85, 93–100

Fads, 74. *See* Habits
Family budget and diet, 71
Famine dropsy, 106
Farming industry. *See* Agriculture
Fasting, 22
Father's food, 52
Fats, 22, 25, 26, 34, 35, 43, 47, 48, 51, 85, 86, 89–93, 97. Table 7
Fat-soluble vitamins. *See* A, D, E
Fatigue, 36
Fattening foods, 91
Feeding stuffs for livestock, 89, 108, 111, 112, 125
Fertility of soil, 112, 114, 121–123
Fertilizers, 108, 111, 124, 125, 128
Fibre, cellulose, 24, 27, 53, 86, 91, 100
Fibrinogen, 25
Figs, 62
First-class proteins, 23, 51, 73, 90, 94
Fish, 54, 55, 62, 63, 73, 94, 113. Tables 7, 12
Fish body oils, 63. Table 12
Fish liver oils, 34, 35, 57, 59, 81, 94. Tables 9, 12
Fish meal, 90
Flesh foods, 52, 53, 57, 65–67, 86, 93, 94
Flour, 61. *See* White flour, Wholemeal flour, Corn flour, Rye flour
Fracture of bones, 36
Free meals for school children, 83
Fresh fruits and vegetables, 36, 49, 58, 59, 64, 65, 86, 99, 100. Tables 9, 10, 11
Freezing, of foods, 67
Frontispiece, explanation, of, 85–87
[illegible], 99

Fruits, 66, 67, 99, 110. *See* Fresh and Dried Fruits
Fuel, food as, 20–22, 24–27, 41, 42, 47, 48, 50, 85, 87, 92, 97, 98

Garlic, 66
Gastric juice, 28, 36, 92, 94
Gastric ulcer, 35
Gastro-intestinal disease, 36, 38.
Gelatin, 23
Germinated seeds, 96. *See* Sprouted seeds
Germ of cereals, 32, 34, 60, 62, 95, 96, 112. Tables 9, 10
Glucose, 49, 68, 98, 99
Glycogern, 27
Goats, 65
Goitre, 28
Gooseberries, 59, 66
Gout, 25
Grape fruit, 66
Grass, 24, 89, 102, 113, 115, 124
Green leaves, salads, 32, 54, 55, 58, 89, 90, 100–102, 121
Green peas, beans. *See* Peas, Runner beans
Green plants and vegetables, 32, 34, 64, 66, 67, 71, 112
Growth, 15, 23, 24, 29, 33, 42, 47, 51, 80, 87, 89
Gums, disease of, 4, 36, 37

Habits, fads, food and, 36, 41, 47–49, 72
Haddock, 64
Haemoglobin content of blood, 29, 39, 99
Halibut oils, 57, 59, 68, 87. Tables 9, 12
Ham, 62, 93
Hard roe, 62
Hawthorn berries, 65
Hazel nuts, 62
Health, national, 14–18
Healthy diet, 60, 82. *See* Square Meals
Heart, diseases of, 14, 36, 99
Heart, of sheep, of pig, of ox, 62, 77
Hearts of vegetables, 58
Heating, effect of on food, 59, 64 67. *See* Cooking, Boiling
Height, 16, 42

Herbivorous animals, ruminants, 24, 27, 29
Herbs, 100–103
Herring, 57, 70, 94, 107
Herring roes, 62
Hips and Haws, 57, 65, 102
Home grown food, produce, 93, 106–111, 116
Home made jam, 64, 99
Honey, 97, 99
Horseradish, 66, 102, 103. Table 11
Hotel food, 50
Housing and malnutrition, 81, 118
Human milk, 51, 59
Humus, 125–128
Hungermalacia, 108
Hydrochloric acid, 36

Ice cream, 98
Imported foodstuffs and feeding-stuffs, 93, 107–112, 125
Incipient scurvy, 66
Income and diet, 11, 16, 48, 62
Increasing body weight, 41
Indigestion, 39, 63. *See* Digestive troubles
Infants, food of, 20, 51, 55, 58–60, 63, 64, 66–68, 87, 100
Infantile beriberi, 35
Infantile scurvy, 36, 105
Infections, resistance to, 35–38
Infectious diseases, 35, 39, 110
Inflammatory conditions, 35
Influenza, 37, 79, 91
Insanity, 53
Intensive production of milk, of eggs, 90, 91
Internal organs, 65
International vitamin standards, units, 30, 56
Invalids, food of, 63, 93
Iodine, 28, 29, 38, 54, 55, 94, 123
Iron salts, 17, 29, 39, 54, 55, 95, 99. Table 8
Irradiation of foods, 34, 6. Table 12
Isolated communities, diet of, 81
Isolation of vitamins, 35

Jam, 97, 98. Table 7

Kale, 57, 64–66, 81, 87
Kidney, 58, 62. Tables 9, 10

Lactation, 29, 52, 55, 58, 60, 87, 91
Lactoflavin, 33, 63
Lactose. *See* Milk sugar
Land fertility subsidy, 107
Lard, 89
Large scale catering, 72–80
Leaf and seed mixture, 53, 54, 89, 90
League of Nations, Food Committee, Standard, 44, 47, 51, 56, 61, 68, 106
Lean of meat, 62, 64, 93. *See* Flesh
Leaves and leaf vegetables, 24, 32, 53, 54, 57, 100, 101, 103. *See* Green leaves
Leeks, 66
Legumes. *See* Beans, lentils, peas, peanuts, pulses
Lemon, 66. Table 11. *See* Citrus fruits
Lentils, 54, 59, 62. Tables 9, 10
Lettuce, 57, 58, 101
Light. *See* Sunlight, Ultra-violet rays
Lime salts, 28. *See* Calcium
Liver, 29, 32, 35, 36, 56–59, 62, 64–67, 94. Tables 9, 10, 11, 12
Livestock, reduction of in wartime, 108
Livestock, feeding of. *See* Cattle
Lobster, 86
Loganberries, 66
Longevity, 94
Loss of appetite, 35
Loss of weight, 41, 42. *See* Slimming
Low energy value diets, 46
Low protein diets, 53
Low resistance to infection, 37
Lung, diseases of. *See* Tuberculosis, Bronchopneumonia

Macaroni, 96
Machine milling, 59, 95, 96
Mackerel, 94
Magnesium salts, 29, 54, 123
Maize, 36, 49, 58, 62, 63, 96
Malnutrition, 11, 13–20, 39, 91, 121
Malnutrition and the cost of living, 116–120
Malnutrition and housing, 118, 119
Malnutrition, prevention of, 119, 120
Malnutrition, standards for assessing, 38–40

Malt, malt extract, 62, 63, 96, 99
Man's food requirements, 44, 55, 58, 60, 65
Manganese, 29, 54
Mango, Table 9
Manure, 29, 108, 123, 125, 126
" Man Value " co-efficients, 44–47, 71, 72, 77
Margarine, 58, 97. Tables 9, 12
Marketing Boards, 116–118. *See* Milk Marketing Boards
Markets for perishable foods, 11, 82, 118
Marmalade, 64
Marmite, 36, 62, 63. Table 10
Marrow of bone, 32, 57, 59
Marrow, vegetable. Table 10
Maternal mortality, 15, 16, 18, 52
Meals, 69, 74, 76, 80, 84
Meat, 24, 25, 35, 49, 63, 64, 85, 86, 93. Table 7
Meatless school diet, 79, 80
Meat substitutes, 95, 97. *See* Vegetarianism
" Medical Testament," 17, 18
Melon, canteloupe, 99
Mental symptoms, insanity, 36, 53
Menus, 12, 69, 76, 80, 84
Middle age, diet in, weight in, 41, 50
Middlings, 59, 62, 63, 84, 96. Tables 9, 10
Milk, 24, 30, 35, 49, 51, 53, 54, 57–59, 62–66, 87–91, 94, 95, 110, 116. Tables 3, 7, 9, 10, 11
Milk Marketing Boards, 88, 110
Milk sugar, lactose, 94, 95, 98, 99
Millet, 62
Milling, 54, 60, 63, 96, 112
Mineral salts, 21, 22, 28–31, 37–39, 54, 68, 70, 71, 86, 87, 95, 97, 99, 101. Tables 8, 14
Minimal requirement, of proteins, 47, 50, 51
Minimal requirement, of vitamins, 58, 60, 65, 68
Mint, Tables 9, 11
Model diet unit, 58, 72, 73
Molasses, 99
Morning sickness, 99
Mother's diet, 35, 52, 58, 59, 65, 71, 84, 87
Mucous membranes, 35
Mushroom, 62
Mutton, 62
Mutton fat. Table 9

Nasal sinus, infection of, 35
National Health Insurance, 17, 18, 119
Nation, feeding of a, 72, 106, 107
Natural cycle of life, 111
Natural foods, 26, 31, 62, 68, 81, 82, 87, 96, 98, 102, 115
Nervous symptoms, 35
Nettlerash, 25
Nettles, 102
Nicotinic acid, vitamin B_7, anti-pellagra substance, 32, 36, 63
Nightblindness, 35, 59
Nitrogenous foods, 23, 52, 124, 128
Nitrogenous manures, 108, 124
Normal health, definition of, 39
Nose bleeding, 36
Nursing mother's diet, 51, 58, 60, 87. *See* Lactation
Nutrition, defined, 13, 121
Nutritional errors, 16, 18. *See* Vitamin underfeeding
Nuts, 25, 53, 62, 63, 97. Tables 7, 9, 10, 11

Oatmeal, 54, 62, 81, 87, 96
Oats, 63, 64
Obesity, 91, 92
Occupation and food requirements, 44
Offals of grain, 113
Oils, animal or fish, 34, 94, 97
Oils, vegetable, 25, 32, 34, 36, 97, 100
Olive oil, 25
Olives, Table 8
Onions, 62
Optimal diet, 45, 58–60, 63, 74, 75
Oranges, 36, 59, 64, 66, 99. Tables 9, 11
Oslo breakfast, 88
Outer leaves of vegetables, 54, 57, 58, 100
Over-cooking, 89
Overdosage with vitamin D, 31
Over-eating, -nutrition, -weight, 13, 42, 46, 91
Ox kidney, 58, 62. Table 9

Ox liver, 58, 66. Table 9
Ox muscle, flesh. *See* Beef.
Oxidation, destruction of vitamins, 57, 64, 105
Oysters, 91, 94. Table 9

Pains in limbs and joints, 36
Paralysis, 35
Parsley, 66, 102, 103. Tables 9, 11
Parsnips, 59, 66. Tables 9, 11
Pasteurized milk, 57, 58, 88, 94, 110
Pastures, 90, 110, 112, 113, 115. *See* Grass
Peach, 105
Peanuts, 96
Pears, 65, 105
Pearl barley, 59, 96
Peasants, diet of, 81
Peas, dried, 25, 62, 89, 96
Peas, dried, sprouted, germinated, 96, 97, 101. Table 11
Peas, green, 59, 62, 66, 105, 112. Tables 9, 10, 11
Pectins, 26, 27
Peel, rind, of fruit, 57, 67
Pellagra, 33, 36, 53, 63, 64, 114
Pellagra preventing substance, 63, 64. *See* Nicotinic acid
Peppers, fresh, 64–66. Table 11
Percentage analyses of foods. *See* Coloured charts and Table 7
Perfect teeth, 81
Perishable foods, 106, 111
Pernicious anaemia, 14, 36
Perspiration, 23, 28
Phosphorus, phosphates, 28, 39, 54, 55, 67, 68. Table 8
Physical condition, physique, 14–18, 39
Pigments, 29, 32, 33, 90
Pig's heart, 62
Pig's kidney, 62
Pig keeping, 33, 89, 113, 114
Pig liver, 66
Pigs, as food, 63. *See* Bacon, Ham, Lard, Pork
Pilchards, 57, 94
Pineapple, 59, 66
Pl[illegible], proteins, 23, 24, 52, 53, 69, 86. Table 4
Plants, mineral salts in, 54, 55, 124. Table 8
Plant to Prosper Campaign, 114, 120
Plums, 65, 105
Polished and unpolished rice, 96
Poorer classes diet of, 60. *See* Working classes
Poor Physique, 15, 20
Pork, 62, 89, 97. Table 10
Porridge, 48, 84, 91, 96
Potassium, potash, 28, 29, 55, 123, 126
Potatoes, 62, 65, 67, 71, 74, 81, 82, 87, 99, 100, 104, 112, 124. Tables 10, 11
Poultry and game, 93. Table 7. *See* Chicken
Poultry, feeding of, 89, 113
Precursors of vitamins, 31, 32, 67. *See* Carotene, Ergosterol
Pregnancy, diet in, 17, 28, 44, 51, 52, 55, 67, 87, 99
Prevention of illness, 18
Primitive man's food, 38
Proportion of foodstuffs in diet, 47, 48, 51, 69, 70
Protective foods, 21
Proteins, 22–25, 43, 47–53, 56, 67, 85, 86, 89, 90, 93–95, 97. Tables 2, 3, 4
Prunes, dried, 58, 62, 99. Table 9
Puberty, 45, 73
Pullet's eggs, 90
Puerperal septicaemia, 35
Pulses, 25, 29, 53, 96. Tables 9, 10. *See* Beans, lentils, peas
Purposes of food, 19–21
Pus, 39. *See* Septic conditions
Putrefaction of protein, 27
Pyorrhoea, 14, 37

Quality of food, 23, 25, 36, 42, 50, 52, 89, 93, 95
Quantity, amount of food required, 41–48
Quantity of mineral salts required, 54–55
Quantity of protein required, 50–52
Quantity of vitamin A required daily, 58, 59
Quantity of vitamin B_1, 60–63
Quantity of vitamin C, 65, 66
Quantity of vitamin D, 67, 68

Rabbit, 62
Radish, 62, 66
Raisins, 62
Rancid fat, 34, 57
Raspberries, 54, 64, 66, 99
Ratio of protein, fat and carbohydrate, 51, 52, 87
Raw foods, 66, 67, 100, 102. *See* Salads
Red currants, 66, 105
Reducing diet, 91–92
Refined foods, 26, 27, 95
Refuse, household, municipal, utilization of, 125
Reheating of foods, 64, 103
Rejection of army recruits, 15, 16
Rennet, 25
Repair of tissues, 23, 47, 50
Reproduction, 29
Resistance to infection, disease, 21, 35–38, 89
Retention of vitamins, store of, in body, 57, 66
Rhubarb, 66
Riboflavin, 33
Rice, 35, 61, 62, 96
Rickets, 15, 34, 37, 48, 68, 73, 89, 96
Rind, peel, skin, 64. Table 11
Roe of fish, 62. Table 10
Rolled oats, 62
Root vegetables, 27, 100
Rose hips. Table 9. *See* Hips and Haws
Roughage, 27
Runner beans, 59, 62, 105. Table 9
Rye, 62, 89, 96, 103, 112

Sago, 26, 61, 86
Salads, 49, 100–104. Table 14
Salmon, 57, 64, 70, 82, 94, 105. Table 9
Salt, 124 *See* Sodium chloride, Table salt
Salts. *See* Mineral salts
Salvage of waste materials, 126, 127
Sandwiches for school children, 88
Sardines, 54, 57, 59, 70, 94
Sauces, 103, 104. Table 14
Scallops, 91, 94
School children, health of, 17, 38–40
School diets, 45, 46, 73–80
School meals, 88, 89
Scientific feeding of animals, 89
Scurvy, scorbutus, 33, 36, 65, 73, 96, 101–103, 105
Sea fish, sea food products, 29, 30, 54, 55, 94
Sea sickness, 99
Seaweed, 29, 123
Second class proteins, 23, 24, 86. Table 4
Seeds, 24, 27, 53, 86, 89, 90, 100, 110
Seeds, oils from, 32
Self contained system of agriculture, 111
Semolina, 59
Sewage, utilization of, 123, 125
Sheep, feeding of, 113
Sheep's heart, kidney, liver, 62
Shell fish, 25, 29, 94
Shillingsworths of foodstuffs. Tables 4, 5
Simple diets, simple Square Meals, 81, 87, 95
Skim milk, 95
Skin, rind, peel, of fruit, 57
Skin, complexion, 14, 33, 36, 102
Slimming diet, 91
Soda, sodium bicarbonate, 59, 64, 67, 71, 104. *See* Alkaline salts
Sodium, 123
Sodium chloride, 28, 86
Soft roe, 62
Soil, 54, 55, 85, 111, 123, 124
Sorrel, 102
Sour milk, 94
Soya bean, 58. Table 9
Spinach, 58, 66. Tables 9, 10, 11
Sprouted seeds, 96, 101. Table 11
Square Meals, frontispiece, 31, 32, 38, 46, 56, 63, 74, 81, 85–92, 101, 106, 109
Standards, dietary, 47, 50, 51
Standards, physical, health, 14, 16, 38–40, 61
Starch, 26, 27, 48, 70, 73, 86, 91, 96, 99, 100
Sterility, in women, 36
Stewed food, 59, 62
Stiebeling Standard, 50, 51, 70
"Stone" in kidney, bladder, 35, 68 102

Storage of foods, 57, 67, 107, 109
Storage, reserves, of fats, minerals, vitamins in the body, 26, 29, 57, 58, 90
Strawberries, 65, 66, Table 11
Structural material, 20–22, 47, 50
Subnormal nutrition, 46. *See* Vitamin underfeeding
Subsidies, agricultural, 106, 107, 109, 110
Sugar, 26, 27, 35, 36, 49, 70, 73, 81, 86, 92, 94, 96–100, 106, 107, 111
Sulphur, 29, 55, 124
Summer, foods in, 35, 57, 58, 59
Sunlight, sunshine, 32, 34–36, 57, 67, 85, 89, 121
Supplementary proteins, 24. *See* Seed and leaf
Suprarenals, 38
Swede turnip, 36, 66, 100, 112. Table 11
Sweets, sweetmeats, 65, 72, 82, 98, 105
Synthesis of vitamins, 31
Syrup, molasses, treacle, 97–99. Table 7

Table salt, 29, 55. *See* Sodium chloride
Tangerine, 66
Tapioca, 26, 61, 86
Tea, 65
Teeth, 14–17, 28, 29, 34, 36, 37, 39, 54, 55, 67, 81, 98
Temperature and food requirements, 43
Tests for vitamins, 30
Thiamin, 33
Thyroid gland, 28, 38
Tinned foods, 59, 104. *See* Canned foods
Tin-opener, defence of, 104, 105
"Tired Eggs," 90
Tocopherol, 34. *See* Vitamin E
Tomatoes, 36, 58, 59, 62, 64, 66, 99, 105, 106. Tables 9, 10, 11, 14
Tongue, 62
Total protein, 71
Treacle, 99
Tripe, 62
Tristan da Cunha, 81
Tuberculosis, 35, 48, 89, 91, 108
Tubers, 27, 100
Turnips, 62
Turnip tops, greens, 57, 64, 66. Tables 9, 11
Typical day's food, 69–71

Ulcers, 38
Ultra-violet rays, 34, 67, 121
Underfeeding with vitamins, 32, 34–40
Utilization of town and domestic wastes as manure, 123–128

Variation in vitamin content of foods, 58, 64, 90
Vegetable, fats and oils, 26, 49
Vegetables, 54, 100–103. Tables 7, 8, 9, 10, 11, 14. *See* Fresh fruits and vegetables
Vegetarianism, 24, 28, 52, 53, 63, 97
Vinegar, 28
Visual purple, 35
Vitaminized margarine, 58, 71, 82
Vitamins, 21, 22, 26, 30–40, 50, 85–87
Vitamin A (axerophthol), 26, 32, 34, 35, 37, 38, 40, 70, 73, 82, 89, 90, 94–97, 99–101, 103, 113, 121. Tables 9, 13, 14
Vitamin B complex, 32, 33, 96
Vitamin B_1 (aneurin, thiamin), 33, 36, 38, 40, 59–63, 73, 89, 91, 93–97, 99, 100. Tables 10, 13, 14
Vitamin B_2 complex, 33, 37, 63, 64, 93–95, 99, 100
Vitamin B_6 (adermin), 33
Vitamin B_7 (nicotinic acid), 33, 36, 38, 63–64, 94
Vitamin B_2 (lacto– or ribo– flavin), 33, 63
Vitamin C (ascorbic acid), 33, 36–40, 64–67, 71, 73, 94–97, 99–101 103. Tables 11, 13, 14
Vitamin D (calciferol), 15, 26, 31, 34, 35, 37, 39, 40, 49, 70, 73, 82, 89, 90–95, 97, 100, 110. Tables 12, 13, 14
Vitamin E (tocopherol), 34, 36, 37
Vitamin underfeeding, 32, 34–40

Walnut, 62, 97

War, and deficiency disease, 13, 98, 101, 108
Wartime " Food Front," 102, 107–112
Wartime diets, 46, 50, 108
Waste, allowance for, 44, 58, 73, 77, 86, 93
Water, 22, 23, 86, 91
Watercress, 59, 101, 102. Tables 9, 10, 11
Water-soluble vitamins. *See* Vitamin B complex, vitamin C.
Weaning, diet on, 51, 87, 100
Weight, loss of, reduction of, 41, 46, 91, 108
Wheat, 24, 49, 62, 64, 95, 96, 110, 112
Wheat bran, 62, 95
Wheat germ, 36, 59, 64, 96. Table 9
Wheat subsidy, 107, 111
Whey, 33
White bread, flour, cereals, 29, 35–37, 49, 53, 59–61, 63, 73, 81, 88, 95, 96, 103
White fish, 94
White of egg, 25. Table 2
Wholemeal bread, flour, cereals 37, 49, 53, 54, 61–64, 71, 73, 88 91, 99, 103. Table 9
Whole seed products, 30, 53, 54, 60, 95, 99
Wild fruits, plants, 57, 65, 66, 102. Tables 9, 11
Winter, foods in, 35, 57–59, 65, 90
Woman's food requirements, 44, 54, 55, 60
Work, exercise, and food requirements, 42–44
Working classes, poorer classes, diet of, 40, 46, 52, 61, 62, 88

X ray detection of rickets, 40
Xerophthalmia, 32, 35, 108

Yeast, 32, 36, 62–64, 67, 68, 88, 100. Table 10
Yeast extract, 36, 62, 67, 87, 88, 91, 100
Yellow leaves, bleached, 58, 101
Yellow maize, 58
Yolk of egg, 32, 58, 62, 64, 90. Tables 9, 12